

Management of Sleep Disturbances Following Concussion



Presenter:

Michael R. Yochelson, M.D., MBA
Vice President of Medical Affairs and
Chief Medical Officer
MedStar National Rehabilitation Network
Washington, DC

Presenter:

Emerson M. Wickwire, Ph.D.
Director of the Insomnia Program,
Departments of Psychiatry and Medicine,
University of Maryland School of Medicine
Baltimore, Maryland

March 10, 2016
1-2:30 p.m. (ET)

Moderator:

Panakkal David, M.D.

Traumatic Brain Injury Subject Matter Expert, Division of Clinical Affairs
Contract support to the Defense and Veterans Brain Injury Center
Silver Spring, Maryland



"Medically Ready Force...Ready Medical Force"

DHA Vision



“A joint, integrated, premier system of health, supporting those who serve in the defense of our country.”



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MHS Objectives



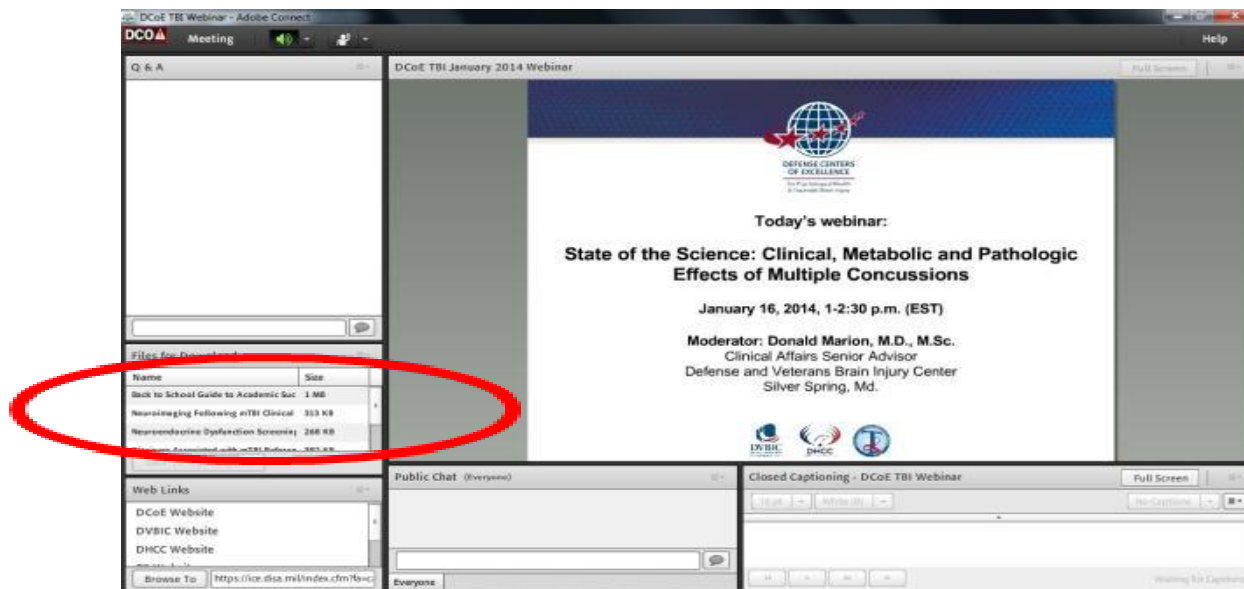
- Promote more **effective and efficient health operations** through enhanced enterprise-wide **shared services**
- Deliver more comprehensive primary care and **integrated health services** using advanced patient-centered medical homes
- **Coordinate care over time and across treatment settings** to improve outcomes in the management of chronic illness, particularly for patients with complex medical and social problems
- **Match personnel, infrastructure, and funding to current missions**, future missions, and population demand
- Establish more **inter-service standards/metrics**, and standard process to promote learning and continuous improvement
- Create **enhanced value in military medical markets** using an **integrated** approach in 5-year business plans
- **Align incentives** with **health and readiness outcomes** to reward value creation
- **Improve the health of the population by addressing determinants of health**

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Resources Available for Download



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Webinar Details



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- Webinar audio is not provided through Adobe Connect or Defense Connect Online
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 - International **773-799-3736**
 - Use participant pass code: **1825070**
- Question-and-answer (Q&A) session
 - Submit questions via the Q&A box

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Continuing Education Details



- DCoE's awarding of continuing education (CE) credit is limited in scope to health care providers who actively provide psychological health and traumatic brain injury care to active-duty U.S. service members, reservists, National Guardsmen, military veterans and/or their families.
- The authority for training of contractors is at the discretion of the chief contracting official.
 - Currently, only those contractors with scope of work or with commensurate contract language are permitted in this training.

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Continuing Education Accreditation



- This continuing education activity is provided through collaboration between DCoE and Professional Education Services Group (PESG).

- Credit Designations include:
 - 1.5 AMA PRA Category 1 credits
 - 1.5 ACCME Non Physician CME credits
 - 1.5 ANCC Nursing contact hours
 - 1.5 CRCC
 - 1.5 APA Division 22 contact hours
 - 0.15 ASHA Intermediate level, Professional area
 - 1.5 CCM hours
 - 1.5 AANP contact hours
 - 1.5 AAPA Category 1 CME credit
 - 1.5 NASW contact hours

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Continuing Education Accreditation



Physicians

This activity has been planned and implemented in accordance with the essential Areas and Policies of the Accreditation Council for Continuing Medical Education (ACCME). Professional Education Services Group is accredited by the ACCME as a provider of continuing medical education for physicians. This activity has been approved for a maximum of 1.5 hours of *AMA PRA Category 1 Credits*™. Physicians should only claim credit to the extent of their participation.

Nurses

Nurse CE is provided for this program through collaboration between DCOE and Professional Education Services Group (PESG). Professional Education Services Group is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation. This activity provides a maximum of 1.5 contact hours of nurse CE credit.

Occupational Therapists

(ACCME Non Physician CME Credit) For the purpose of recertification, The National Board for Certification in Occupational Therapy (NBCOT) accepts certificates of participation for educational activities certified for AMA PRA Category 1 Credit™ from organizations accredited by ACCME. Occupational Therapists may receive a maximum of 1.5 hours for completing this live program.

Physical Therapists

Physical Therapists will be provided a certificate of participation for educational activities certified for AMA PRA Category 1 Credit™. Physical Therapists may receive a maximum of 1.5 hours for completing this live program.

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Continuing Education Accreditation



Psychologists

This Conference is approved for up to 1.5 hours of continuing education. APA Division 22 (Rehabilitation Psychology) is approved by the American Psychological Association to sponsor continuing education for psychologists. APA Division 22 maintains responsibility for this program and its content.

Physical Therapists

Physical Therapists will be provided a certificate of participation for educational activities certified for AMA PRA Category 1 Credit™. Physical Therapists may receive a maximum of 1.5 hours for completing this live program.

Psychologists

This Conference is approved for up to 1.5 hours of continuing education. APA Division 22 (Rehabilitation Psychology) is approved by the American Psychological Association to sponsor continuing education for psychologists. APA Division 22 maintains responsibility for this program and its content.

Rehabilitation Counselors

The Commission on Rehabilitation Counselor Certification (CRCC) has pre-approved this activity for 1.5 clock hours of continuing education credit.

Speech-Language Professionals

This activity is approved for up to 0.15 ASHA CEUs (Intermediate level, Professional area)

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Case Managers

This program has been pre-approved by The Commission for Case Manager Certification to provide continuing education credit to CCM® board certified case managers. The course is approved for up to 1.5 clock hours. PESG will also make available a General Participation Certificate to all other attendees completing the program evaluation.

Nurse Practitioners

Professional Education Services Group is accredited by the American Academy of Nurse Practitioners as an approved provider of nurse practitioner continuing education. Provider number: 031105. This course is offered for 1.5 contact hours (which includes 0 hours of pharmacology).

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This Program has been reviewed and is approved for a maximum of 1.5 hours of AAPA Category 1 CME credit by the Physician Assistant Review Panel. Physician Assistants should claim only those hours actually spent participating in the CME activity. This Program has been planned in accordance with AAPA's CME Standards for Live Programs and for Commercial Support of Live Programs.

Social Workers

This Program is approved by The National Association of Social Workers for 1.5 Social Work continuing education contact hours.

Other Professionals

Other professionals participating in this activity may obtain a General Participation Certificate indicating participation and the number of hours of continuing education credit.

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Questions and Chat



- Throughout the webinar, you are welcome to submit technical or content-related questions via the Q&A pod located on the screen. **Please do not submit technical or content-related questions via the chat pod.**
- The Q&A pod is monitored during the webinar; questions will be forwarded to presenters for response during the Q&A session.
- Participants may chat with one another during the webinar using the chat pod.
- The chat function will remain open 10 minutes after the conclusion of the webinar.

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Webinar Overview



Nearly 340,000 service members sustained a traumatic brain injury (TBI) between 2000 and 2015 with 82.5% of these classified as mild TBI, also known as concussion (Defense and Veterans Brain Injury Center, 2016). Mathias & Alvaro (2012) reported that as many as 50% of people who sustained a concussion suffered from a sleep disturbance.

Additionally, in a 2008 Department of Defense survey of Operation Iraqi Freedom service members, 92.9% of those surveyed with a TBI history endorsed fatigue (Hoge et al., 2008). Sleep disturbances and fatigue can lead to worsening symptoms such as decreased cognition, pain, irritability and ultimately affect return to work.

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Webinar Overview



Clinically, sleep problems may co-exist with headache, somatic pain, and other neurological symptoms, and diagnosis and treatment can be challenging for providers.

This presentation will address the assessment and management of concussion-associated sleep disturbances and fatigue. The speakers will present recent research and discuss ways to enhance quality of life and function in individuals who are experiencing post-concussion sleep dysfunction and fatigue.

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Webinar Overview



At the conclusion of this webinar, participants will be able to:

- Discuss common sleep disturbances following TBI
- Discuss appropriate diagnostic strategies for sleep disorders
- Demonstrate knowledge of fatigue management following TBI
- Articulate pharmacological and non-pharmacological treatment of sleep
- Relate new advances in treatment of sleep disorders

References:

Defense and Veterans Brain Injury Center. (2016). DoD numbers for traumatic brain injury worldwide – Totals.
Retrieved from dvbic.dcoe.mil/dod-worldwide-numbers-tbi

Hoge, C. W., McGurk, D., Thomas, J. L., Cox, A. L., Engel, C. C., & Castro, C. A.. (2008). Mild Traumatic Brain Injury in U.S. Soldiers Returning from Iraq. *New England Journal of Medicine*, 358(5), 453-463.

Mathias, J. L. & Alvaro, P. K. (2012). Prevalence of sleep disturbances, disorders, and problems following traumatic brain injury: A meta-analysis. *Sleep Medicine*, 13(7), 898-905.

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Michael R. Yochelson, M.D., MBA



Michael R. Yochelson, M.D., MBA

- Vice president of Medical Affairs and chief medical officer for the MedStar National Rehabilitation Network in Washington, DC
- Professor of Clinical Neurology and Clinical Rehabilitation Medicine at Georgetown University in Washington, DC
- Vice chair of the Clinical Affairs Department of Rehabilitation Medicine at MedStar Georgetown University Hospital
- Acting chair of the Department of Veterans Affairs' Special Advisory Board on Prosthetics and Special Programs
- Previous Navy neurologist and physiatrist
- Education:
 - M.D., George Washington University School of Medicine and Health Sciences, Washington, DC
 - MBA, University of Maryland, College Park, Maryland

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Emerson M. Wickwire, Ph.D.



Emerson M. Wickwire, Ph.D.

- Director of the Insomnia Program and assistant professor in the Departments of Psychiatry and Medicine at the University of Maryland School of Medicine, Baltimore
- Co-founded a leading interdisciplinary sleep medicine center that became a model for comprehensive sleep medicine centers throughout the country
- Holds a special interest in sleep in military populations and serves as a local site director for the Walter Reed National Army Medical Center/National Capitol Consortium sleep medicine fellowship
- Education:
 - Ph.D., Psychology, The University of Memphis
 - Fellowship, Behavioral Sleep Medicine, Johns Hopkins University School of Medicine
 - Residency (Pre-Doctoral Internship), University of Mississippi Medical Center

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Disclosure



- Dr. Yochelson discloses this financial relationship:
 - Medtronic (SCI Advisory Board, Speaker's Bureau, Principal Investigator, SISTERS Study, The Ability Network)
- The views expressed in this presentation are those of the author and do not necessarily reflect the official policy or position of the Department of Defense, nor the U.S. Government.
- The description of programs in this presentation is for descriptive purposes only and not intended to promote any individual program.

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Polling Question



■ My discipline is:

- ☐ Primary care provider
- ☐ Rehabilitation provider
- ☐ Behavioral health provider
- ☐ Nurse
- ☐ Social worker/case manager
- ☐ Other

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Topics

- Overview of Concussion
- The Impact of Concussion on Sleep & Vice Versa
- Sleep Disorders – general
- Sleep Disorders – TBI
- Fatigue after TBI

Overview of Concussion

- Definition:

- Concussion is a mild brain injury (mTBI).
- Complex pathophysiologic process affecting the brain, induced by traumatic biomechanical forces

McCrary et al., 2013

- Epidemiology (in U.S.):

- TBI: 2.5 million emergency department visits per year
- Sports-related TBI 1.6-3.8 million per year
- 50,000 deaths per year

Makdissi et al., 2010,

Centers for Disease Control and Prevention, 2015

Two (2½) Principal Mechanisms of Traumatic Brain Injury

- Contact Injury
 - An object striking the head
 - The head is generally stationary
 - Contact between the brain and the skull
- Acceleration-Deceleration
 - Unrestrained movement of head, resulting in tensile, shear, and compressive forces. May involve translational or rotational acceleration, or both. Motor vehicle accidents and falls most common here.
- Blast Injury

Mechanisms of Damage Due to Physical Event Affecting the Head

Focal

- Injury to Scalp
- Fracture of Skull
- Surface Contusions/
Lacerations
- Intracranial Hematoma
- Raised Intracranial
Pressure and Associated
Vascular Changes

Diffuse (Multifocal)

- Diffuse Axonal Injury
(DAI)
- Hypoxic-Ischemic
Damage
- Meningitis
- Vascular Injury
- Changes in
neurochemistry

Diffuse Axonal Injury

- At time of impact, rotational forces create shear injury to axons.
- Axon is stretched but may not actually be torn, unless there is very high mechanical loading.
- Damage occurs to the axonal cytoskeleton and a process of damage begins that develops over the course of 72 hours following trauma.
- A region of high vulnerability involves axons traversing the brainstem and involved in the reticular activating system, which contributes to coma and persistent vegetative states seen following severe TBI.

Diffuse Axonal Injury

- Gray-white matter junctions are particularly vulnerable.
- Regions most vulnerable to DAI include:
 - Frontal and temporal white matter
 - Upper brainstem (dorsolateral rostral region)
 - Splenium of the corpus callosum
 - Basal ganglia structures

Overview of TBI

- Experimental (rat) TBI, Changes in:
 - 19 out of 20 neurochemicals in the cortex
 - 9 out of 20 neurochemicals in the hippocampus
- Altered cellular metabolic status after TBI result in multiple potential mechanisms of damage (and possible target areas for treatment):
 - Edema
 - Excitotoxicity
 - Neuronal and glial integrity
 - Mitochondrial status and bioenergetics
 - Oxidative stress
 - Inflammation
 - Cell membrane disruption

Harris, 2012



Concussion Symptomatology

- Somatic (includes fatigue)
- Cognitive
- Emotional
- Sleep (includes sleep dysfunction, excessive daytime sleepiness)



Natural Course of Concussion

- Typical Course – Sports Concussion
 - Less than 4 symptoms
 - Duration approximately 48 hours
 - 18% symptoms > 7 days
- Risk factors for longer post-concussive symptoms
 - 4+ symptoms
 - Headache > 60 hours
 - Fatigue or “fogginess” after injury

Sleep Disturbance after TBI

- Sleep disturbance is common
 - 30-70%

Sleep Disturbances

- MedStar NRH INPATIENT Clinical Experience
 - Overall, approximately 25% of time patients should be sleeping, they are not.
 - However, it tends to be a larger percentage of the time in a fewer number of patients.

Sleep Disturbances

- MedStar NRH INPATIENT Clinical Experience
 - Occurs more frequently in the more agitated patients - Rancho Los Amigos (RLA) scale - 4
 - Tends to occur earlier in their inpatient hospitalization
 - **Transition to new environment?**
 - **Lower level (RLA) at admission?**
 - Better environment (rehab vs. acute hospital) for sleeping?
 - Better management of sleep disturbances in the rehab hospital?

Sleep Disturbances

- Some common descriptions/complaints by patients and/or caregivers:
 - “I just can’t fall asleep.”
 - “I wake up 3-4 times every night.”
 - “He gets confused, especially in the evening.”
 - “She wanders around in the middle of the night.”
 - “He hallucinates.”
 - “She snores.”
 - “She stops breathing.”

Sleep Disturbances

- And often inefficient sleep leads to other problems, such as:
 - Fatigue
 - Agitation
 - Depression
 - Pain
 - Cognitive problems (impaired memory, processing speed, attention, etc.)
- But are these problems related to poor sleep? ... or are these problems directly related to the TBI?...and what is the impact of poor sleep on the TBI recovery?

REST...

- The first treatment prescribed in the recovery of concussion is consistently REST, REST, REST.
- Does it help?
- How much?
- How long?

Leddy, Kozlowski, Fung, Pendergast, & Willer, 2007



Disclosure



- Dr. Wickwire discloses these financial relationships:
 - Merck – moderation of non-commercial scientific discussion
 - WellTap® – equity stakeholder
- The views expressed in this presentation are those of the author and do not necessarily reflect the official policy or position of the Department of Defense, nor the U.S. Government.
- The description of programs in this presentation is for descriptive purposes only and not intended to promote any individual program.

Working Group

Thomas Balkin, Walter Reed Army Institute of Research

Vincent Capaldi, Walter Reed Army Institute of Research

Charles Czeisler, MD, PhD, Harvard University

Anne Germain, PhD, University of Pittsburgh

Michael Jaffe, MD, University of Virginia

Christopher Lettieri, MD, U.S. Army (WRNNMC)

Margaret Macdonald, MD, DVBIC (Contractor, General Dynamics Health Solutions)

Thomas Macek, PhD, Takeda Global Research & Development

Gholam Motamedi, MD, PhD, Georgetown University

Margaret Moline, PhD, Eisai Inc

Gregory Morgan, MD, NICOE

Vincent Mysliwiec, MD, U.S. Army (Brooke Army Medical Center)

Renee Pazdan, MD, U.S. Army (Ft. Carson)

Thomas Roth, PhD, Henry Ford Health System

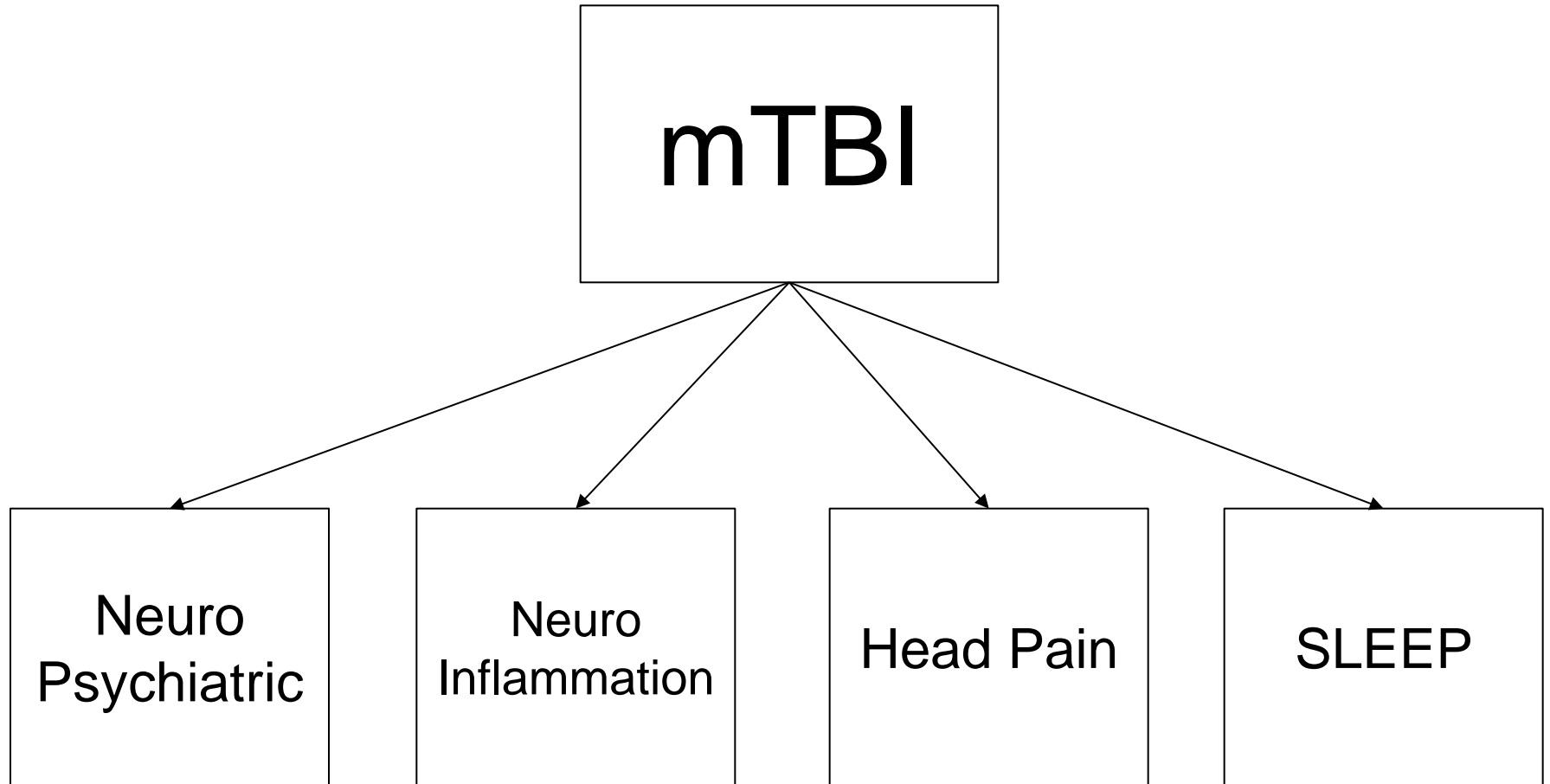
Steven Scharf, MD, University of Maryland

Emerson Wickwire, PhD, University of Maryland

Scott Williams, MD, U.S. Army (WRNMMC)

Michael R. Yochelson, MD, MBA, MedStar Rehabilitation/Georgetown University

Novel Treatment Targets



RUNNING HEAD: SLEEP AND MILD TRAUMATIC BRAIN INJURY

Sleep, sleep disorders, and mild traumatic brain injury -

What we know and what we need to know:

Findings from a national working group

Emerson M Wickwire, PhD^{1,2}; Scott G Williams, MD^{3,4}; Thomas Roth, PhD⁵; Vincent F Capaldi⁶, MD; Michael Jaffe, MD^{7,8,9}; Margaret Moline, PhD¹⁰; Gholam K Motamedi, MD¹¹; Gregory W Morgan, MD¹²; Vincent Mysliwiec, MD^{4,13}; Anne Germain, PhD¹⁴; Renee M Pazdan, MD¹⁵; Reuven Ferziger, MD¹⁶; Thomas J Balkin, PhD⁶; Thomas A Macek, PharmD, PhD¹⁷; Margaret E MacDonald, MD¹⁸; Michael Yochelson, MD, MBA¹⁹; Steven M Scharf, MD, PhD²; Christopher J Lettieri, MD^{3,4}

(under review)

What You'll Learn

- What sleep is
- Why sleep matters for mTBI
- Road map for way forward

Sleep

24.8

Normal, Natural, And Necessary



**“If sleep does not serve some
absolutely vital function, then it is
the biggest mistake the
evolutionary process has ever
made.”**

- Allan Rechtschaffen

Mignot, 2008

S - L - O - W

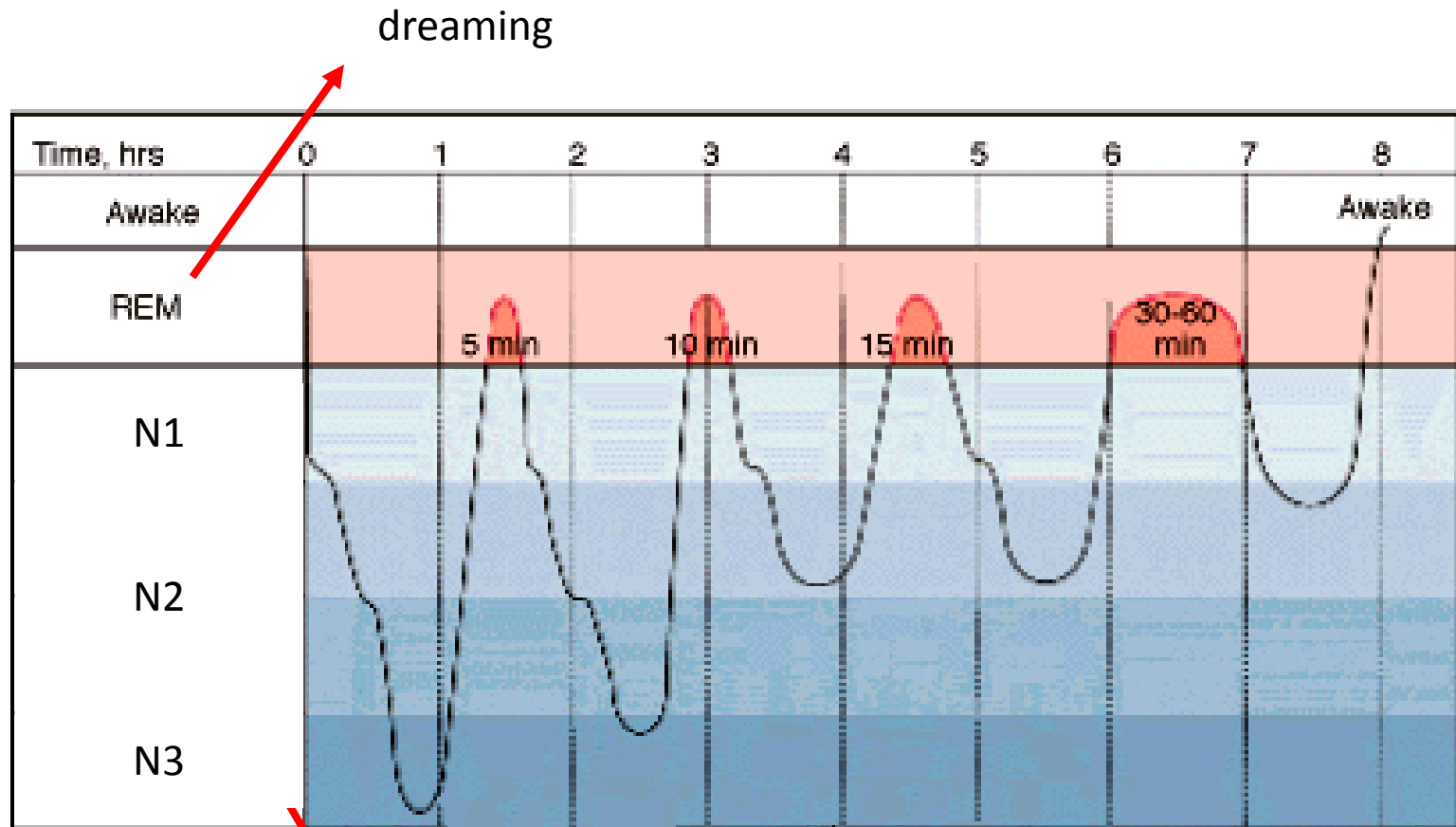
↓ body temperature

↓ respiratory rate/oxygen (O₂) consumption

↓ heart rate

↓ blood pressure

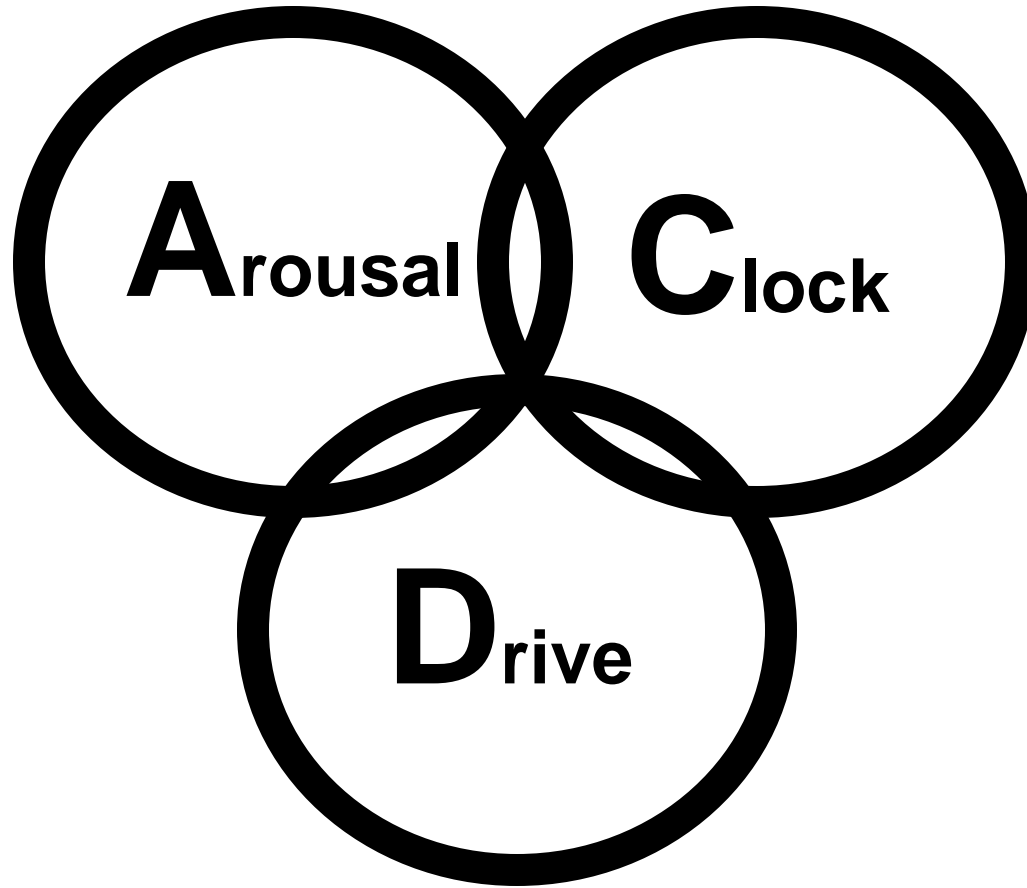
Rhythmic, Organized Stages



Source: Emerson Wickwire, Ph.D.

deep sleep (delta, slow wave sleep or SWS) = rested feeling

What Makes Us Sleep

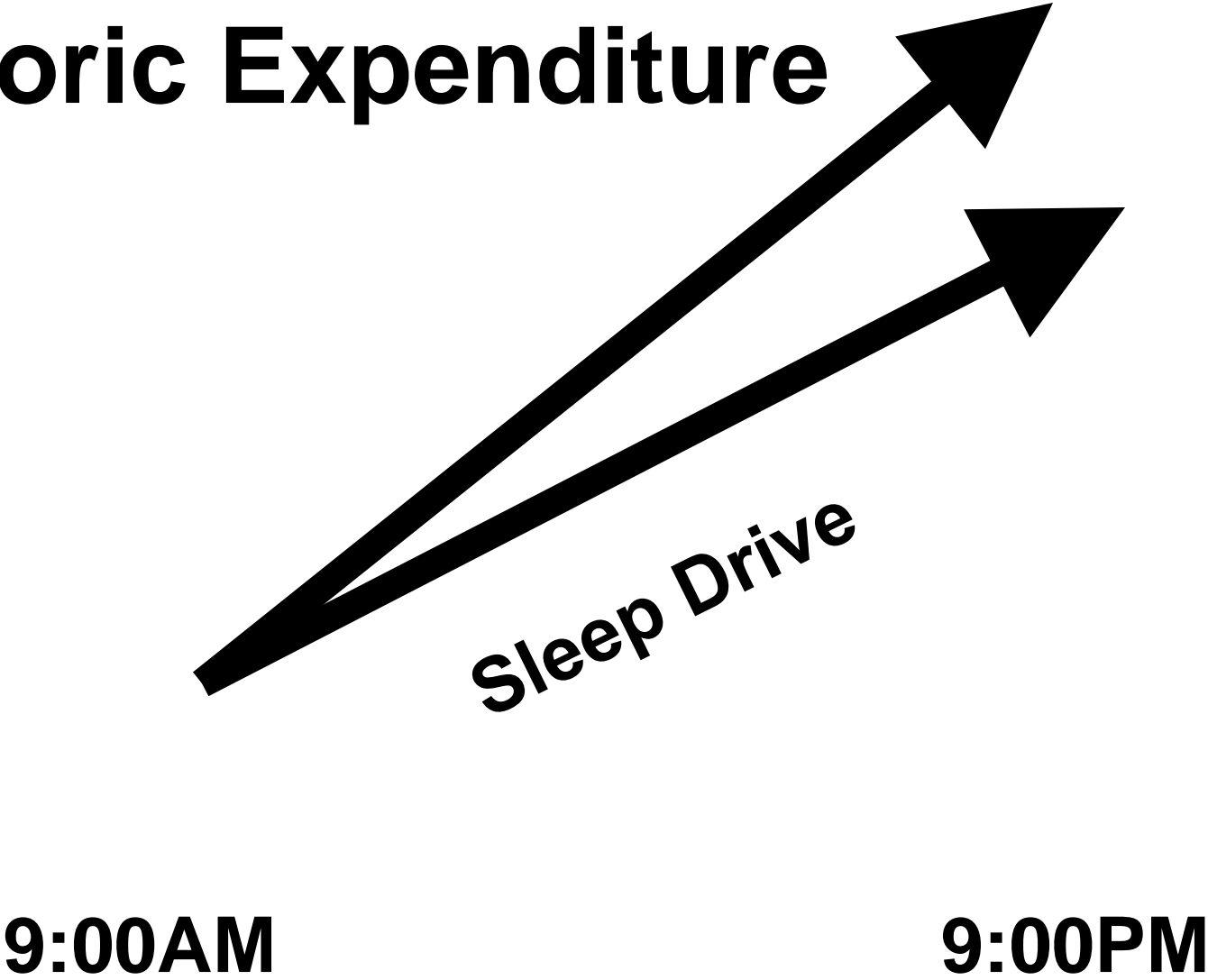


9:00AM

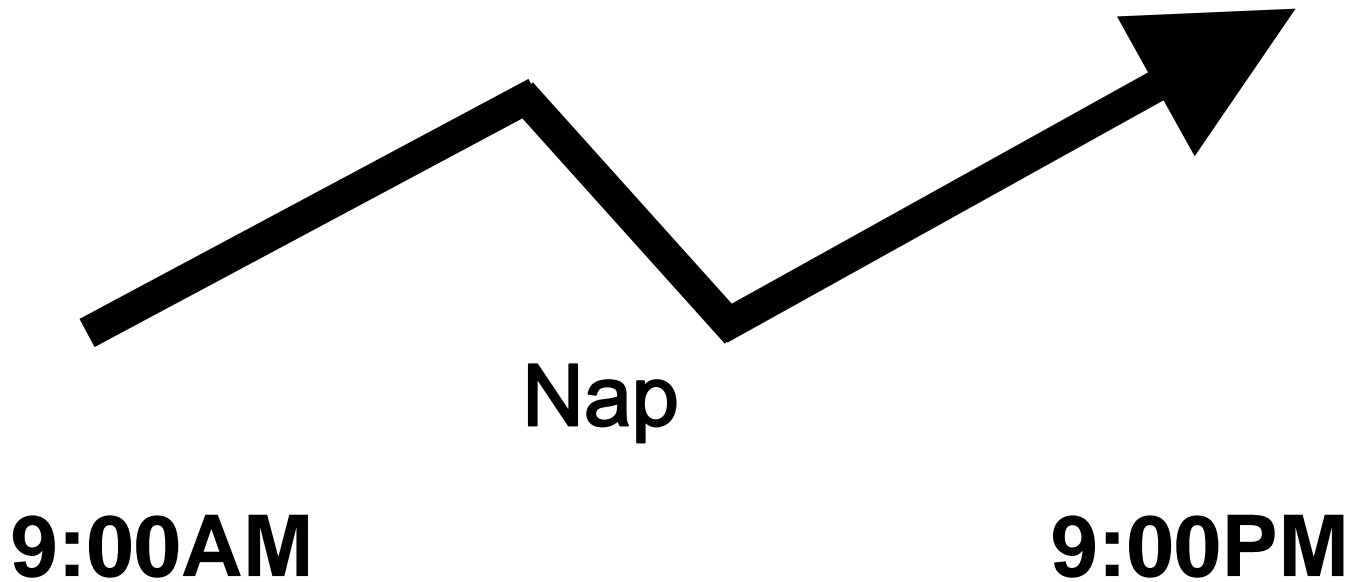
9:00PM



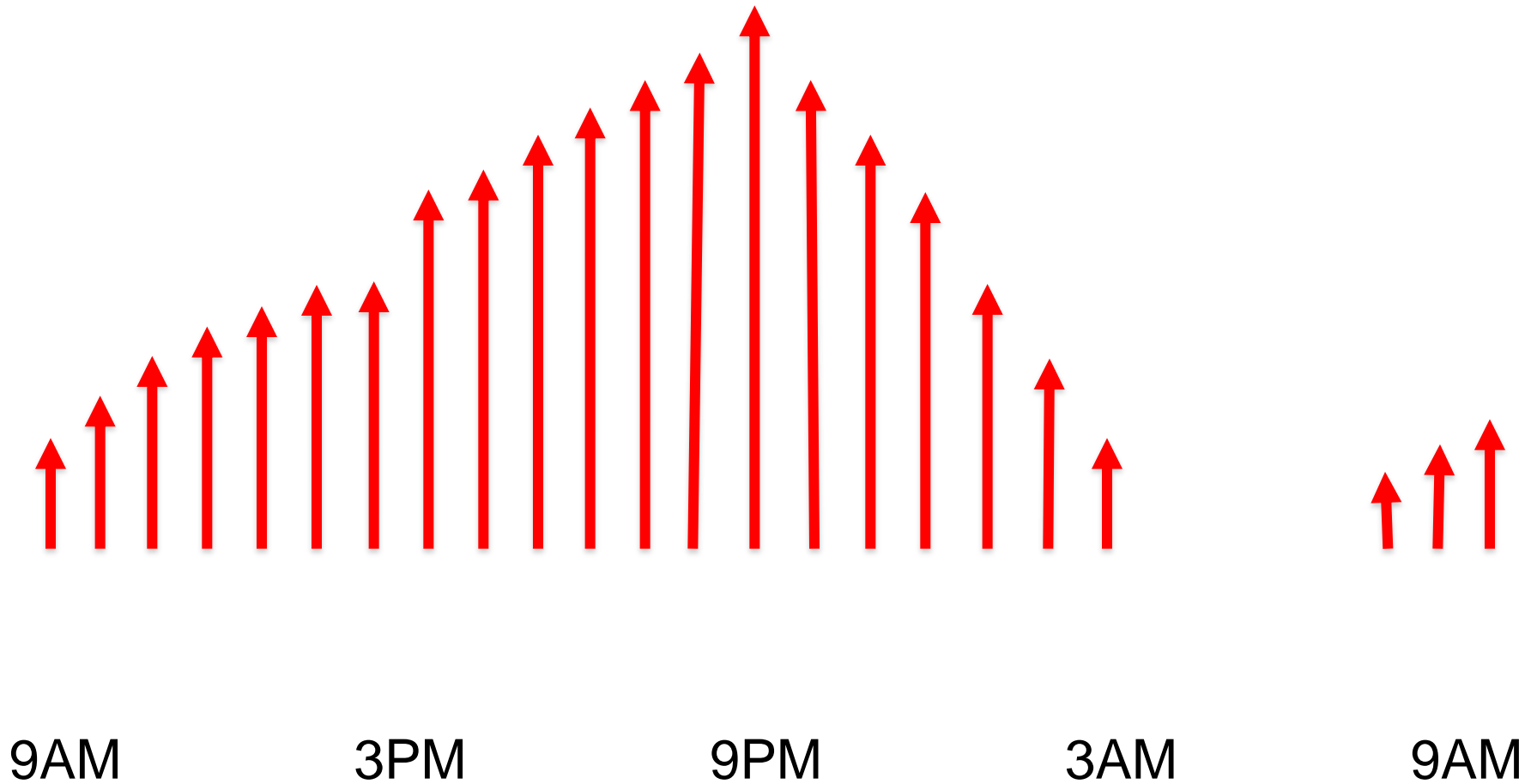
Caloric Expenditure



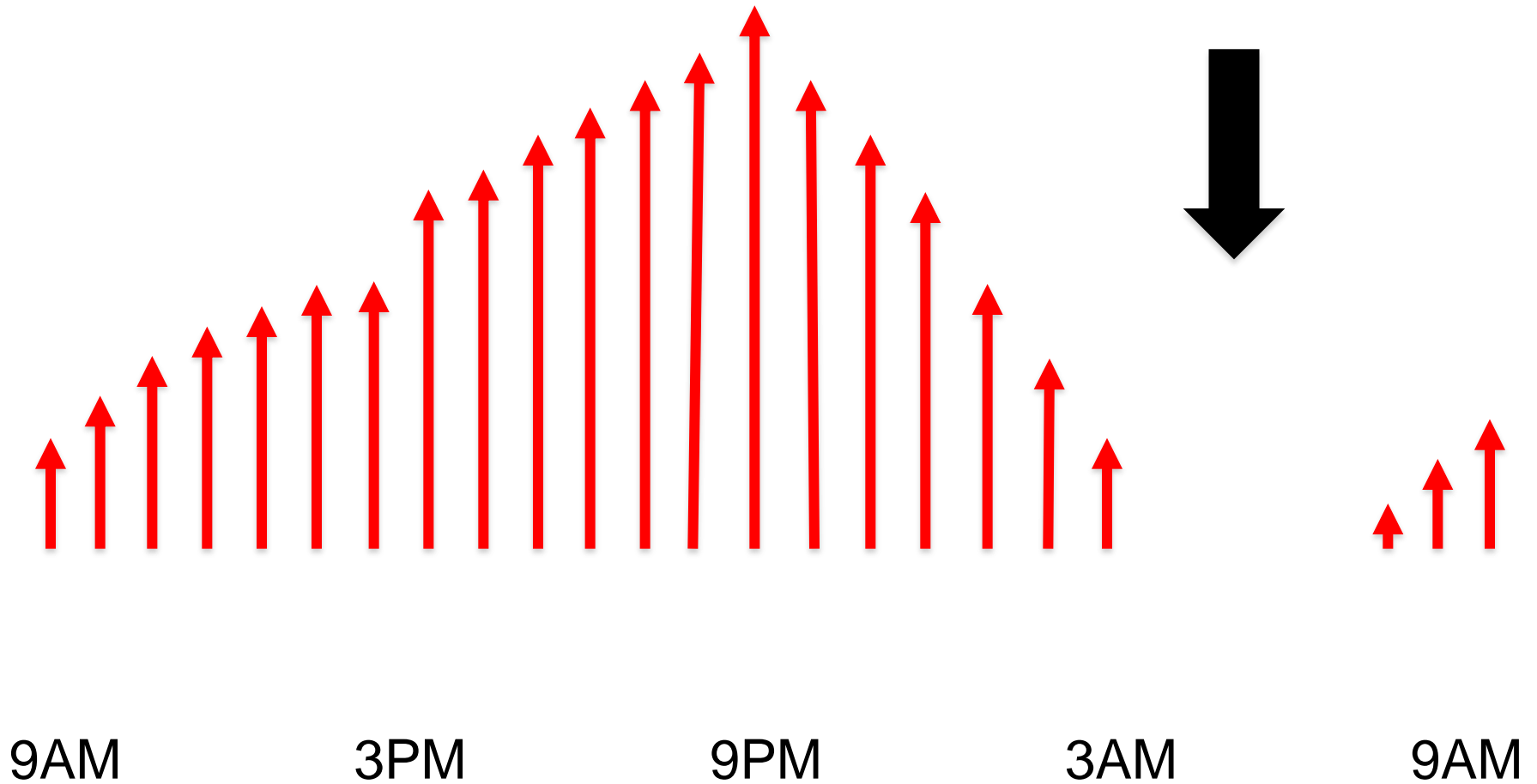
Duration Of Wakefulness

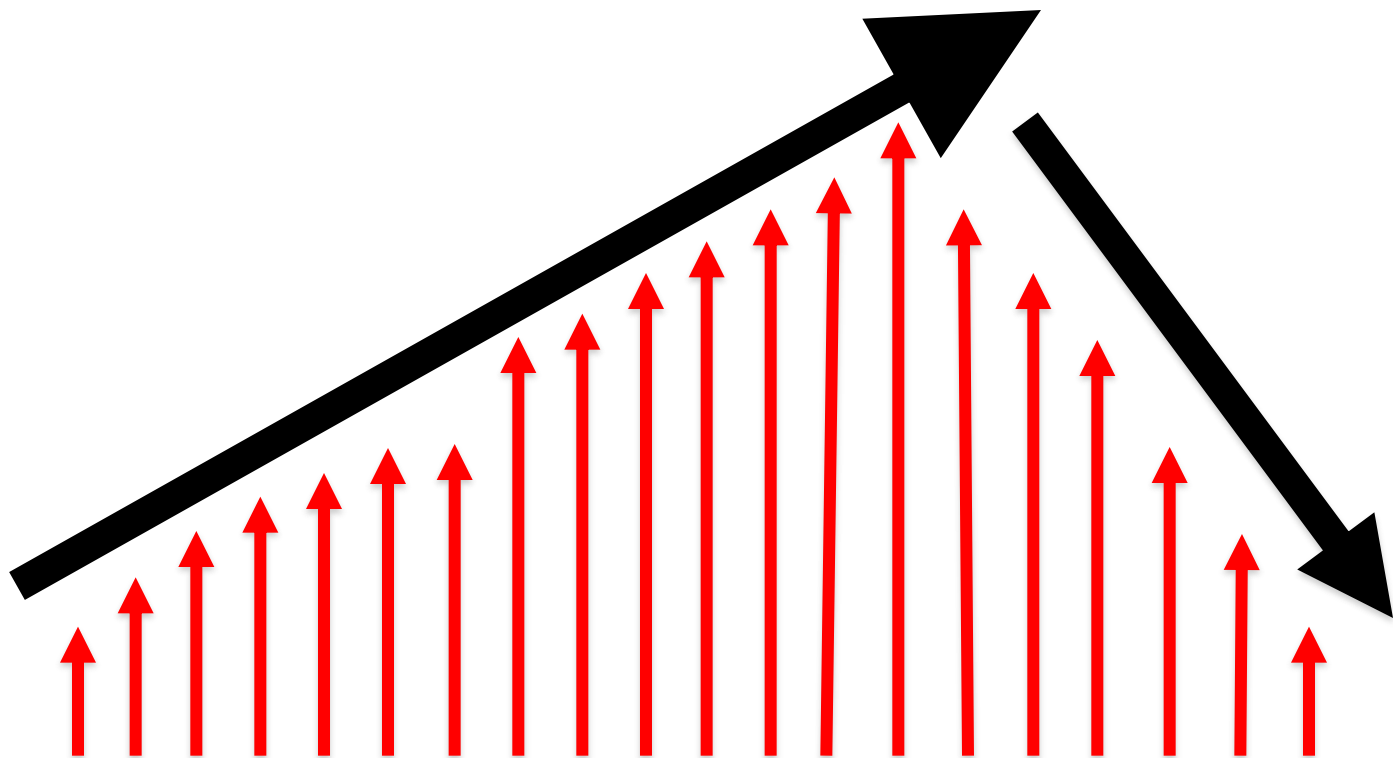


Alerting Signal Keeps Us Awake



**No Alerting Signal
During Night Shift**



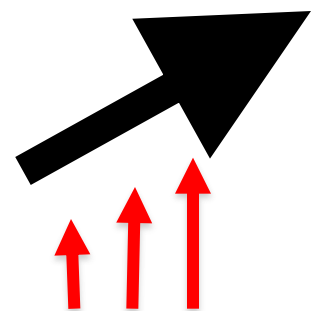


9AM

3PM

9PM

3AM



9AM

LIGHT

Retino-thalamic tract

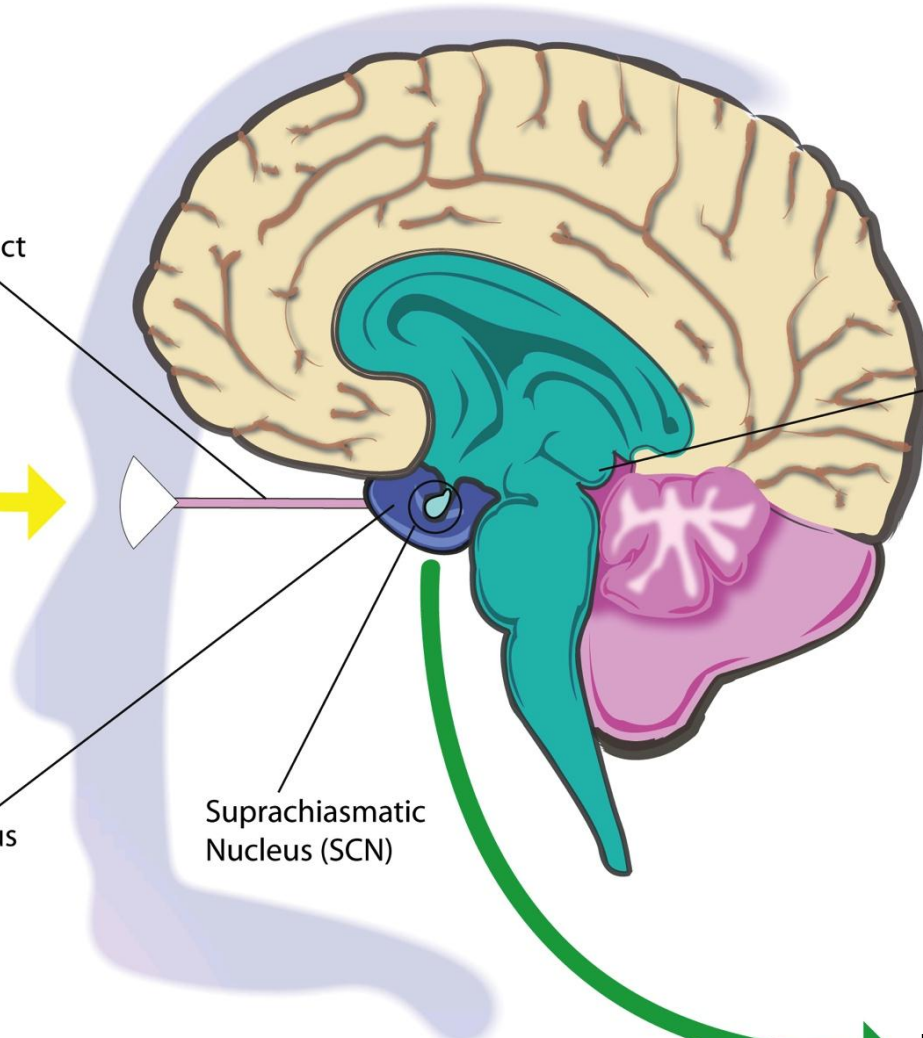
Pineal Gland

Hypothalamus

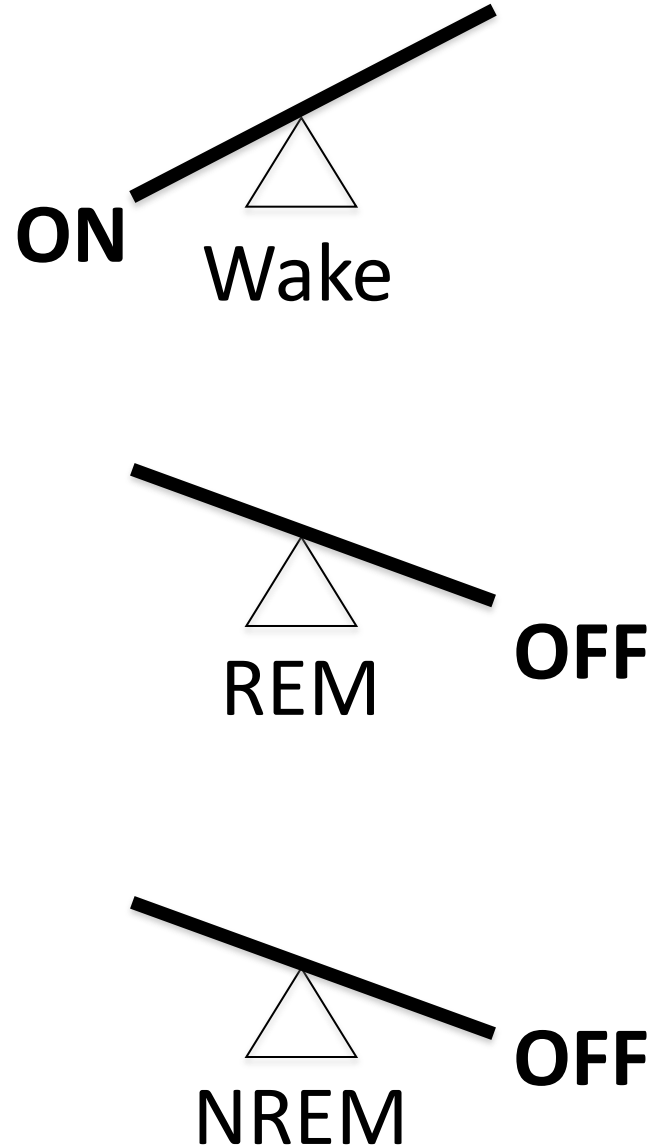
Suprachiasmatic
Nucleus (SCN)

RHYTHMS

Source: Emerson Wickwire, Ph.D.



Mutual Inhibition- Switches/Gates



How Sleep Is Measured

Reference:
Polysomnogram

Proxy:
Actigraphy

Subjective:
Sleep diary



Patient name: _____

date →	7/30	/	/	/	/	/	/	/
Daytime Activities (Complete before bed.) (Note duration & time of day.)								
Number of naps & time spent napping	30m @ 2PM							
Any exercise you performed & time of day	45m walk @3PM							
Any alcohol you drank	1 wine @ 7:30PM							
Medication(s) taken at bedtime:	Ambien CR 12.5mg @9:30PM							
Sleep Parameters (Complete each morning.) ("Best guess" OK.)	(7/31)							
Time that you went to bed last night	10:40							
How long it took you to fall asleep	60m							
Num of times that you woke up during night	2							
Total time you were awake during night	90m							
Time of your final awakening	6:30							
Time that you got out of bed to start today	7:10							
Sleep quality rating? (1-poor to 5-excellent)	2							

Notes: _____

(University of Maryland School of Medicine, 2016)



Patient name: _____

date →	7/30	/	/	/	/	/	/	/
Daytime Activities (Complete before bed.) (Note duration & time of day.)								
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Sleep quality rating? (1-poor to 5-excellent)	2							

Sleep Latency (SOL)

Notes: _____



Patient name: _____

date →	7/30	/	/	/	/	/	/	/
Daytime Activities (Complete before bed.) (Note duration & time of day.)								
Number of naps & time spent napping	30m @ 2PM							
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Wake After Sleep Onset (WASO)

Notes: _____



Patient name: _____

date →	7/30	/	/	/	/	/	/	/
Daytime Activities (Complete before bed.) (Note duration & time of day.)								
Number of naps & time spent napping	30m @ 2PM							
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Waketime

Notes: _____



Patient name: _____

date →	7/30	/	/	/	/	/	/	/
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Sleep Quality (QUAL)

Notes: _____



Patient name: _____

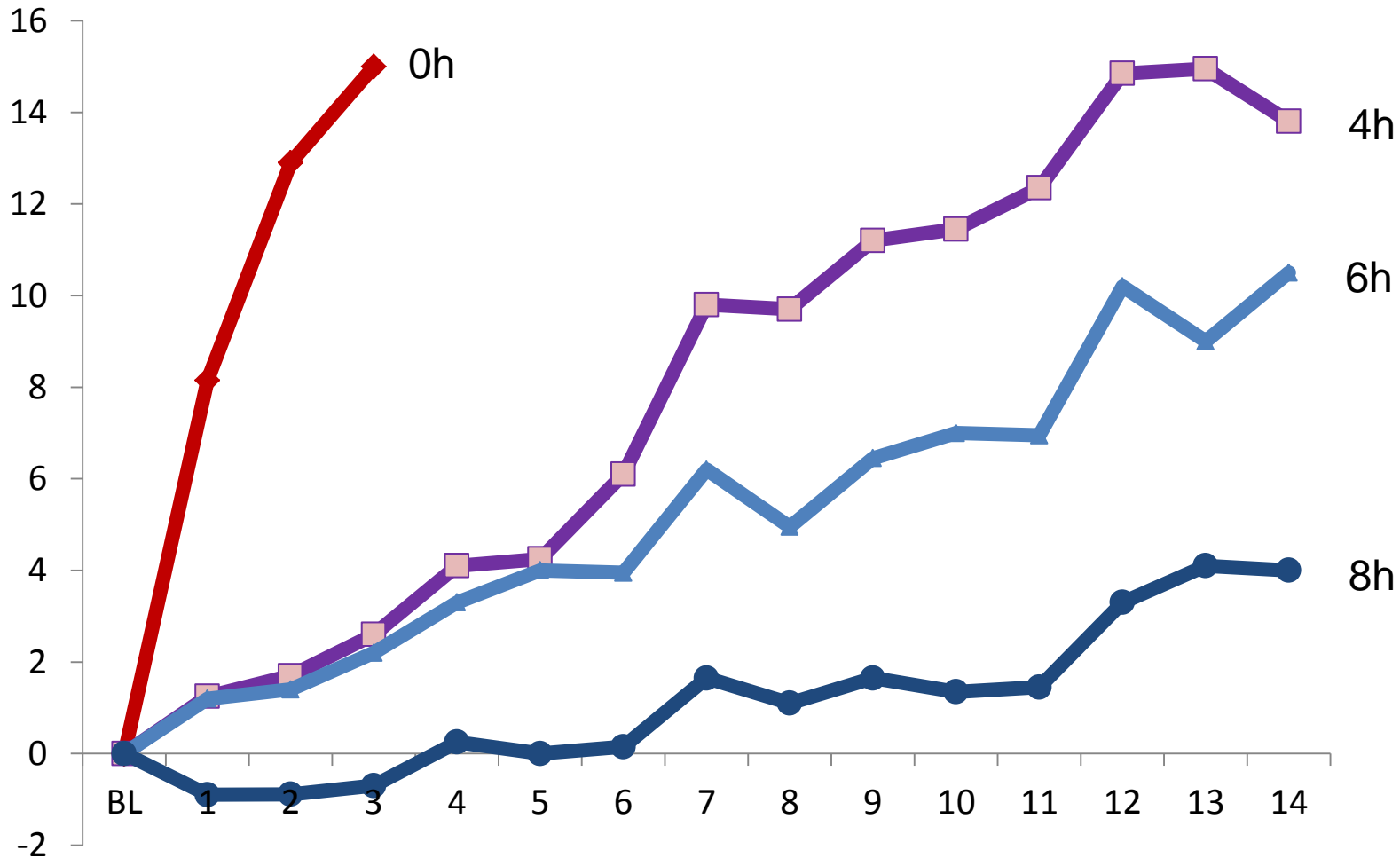
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Any alcohol you drank	1 wine @ 7:30PM							
Medication(s) taken at bedtime:	Ambien CR 12.5mg @9:30PM							
Sleep Parameters (Complete each morning.) ("Best guess" OK.)	(7/31)							
Time that you went to bed last night	10:40							
How long it took you to fall asleep	60m							
Num of times that you woke up during night	2							
<u>Total</u> time you were awake during night	90m							
Time of your final awakening	6:30							
Time that you got out of bed to start today	7:10							
Sleep quality rating? (1-poor to 5-excellent)	2							

Total Sleep Time (TST)

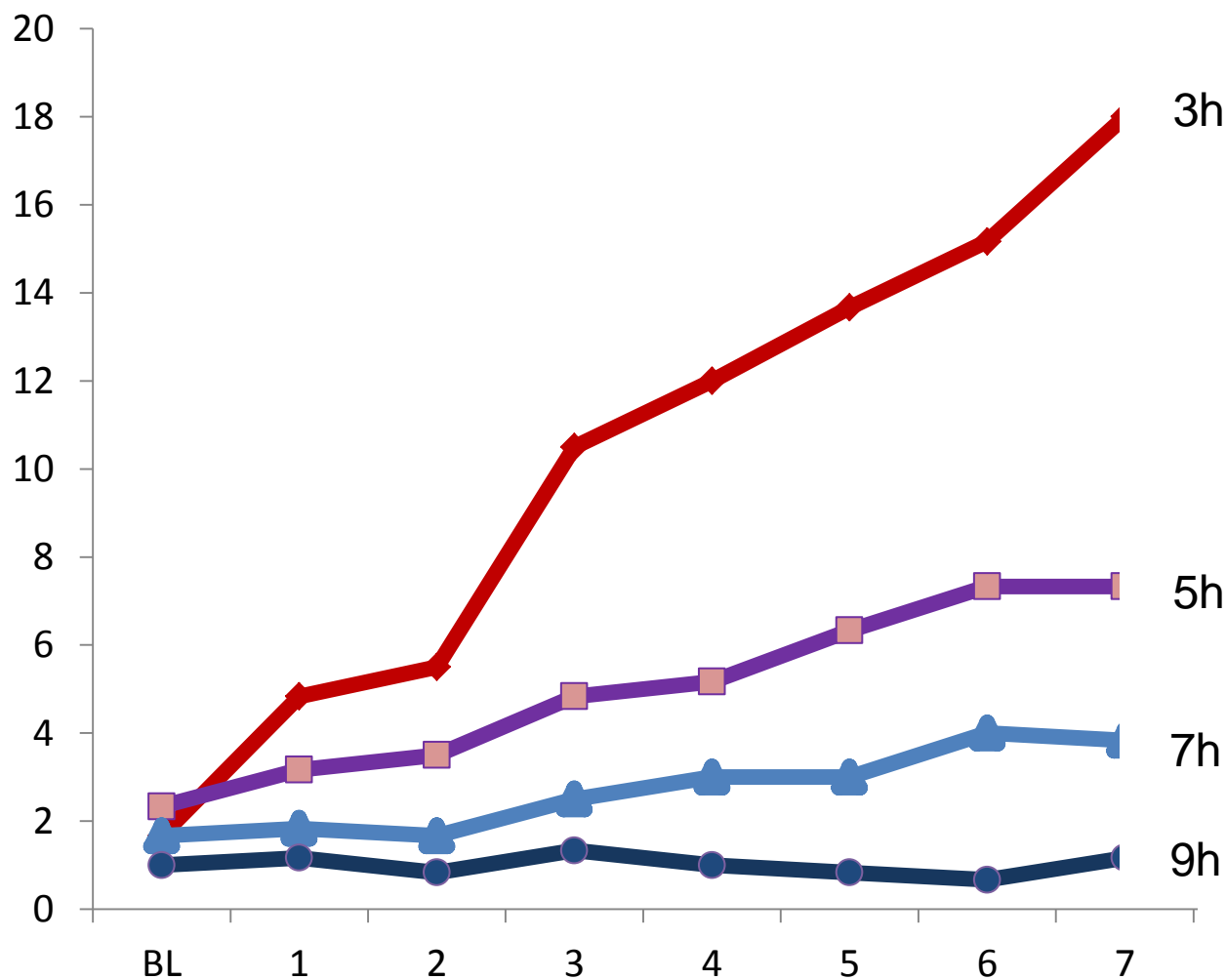
Sleep Efficiency (SE)
time slept/time in bed

Notes: _____

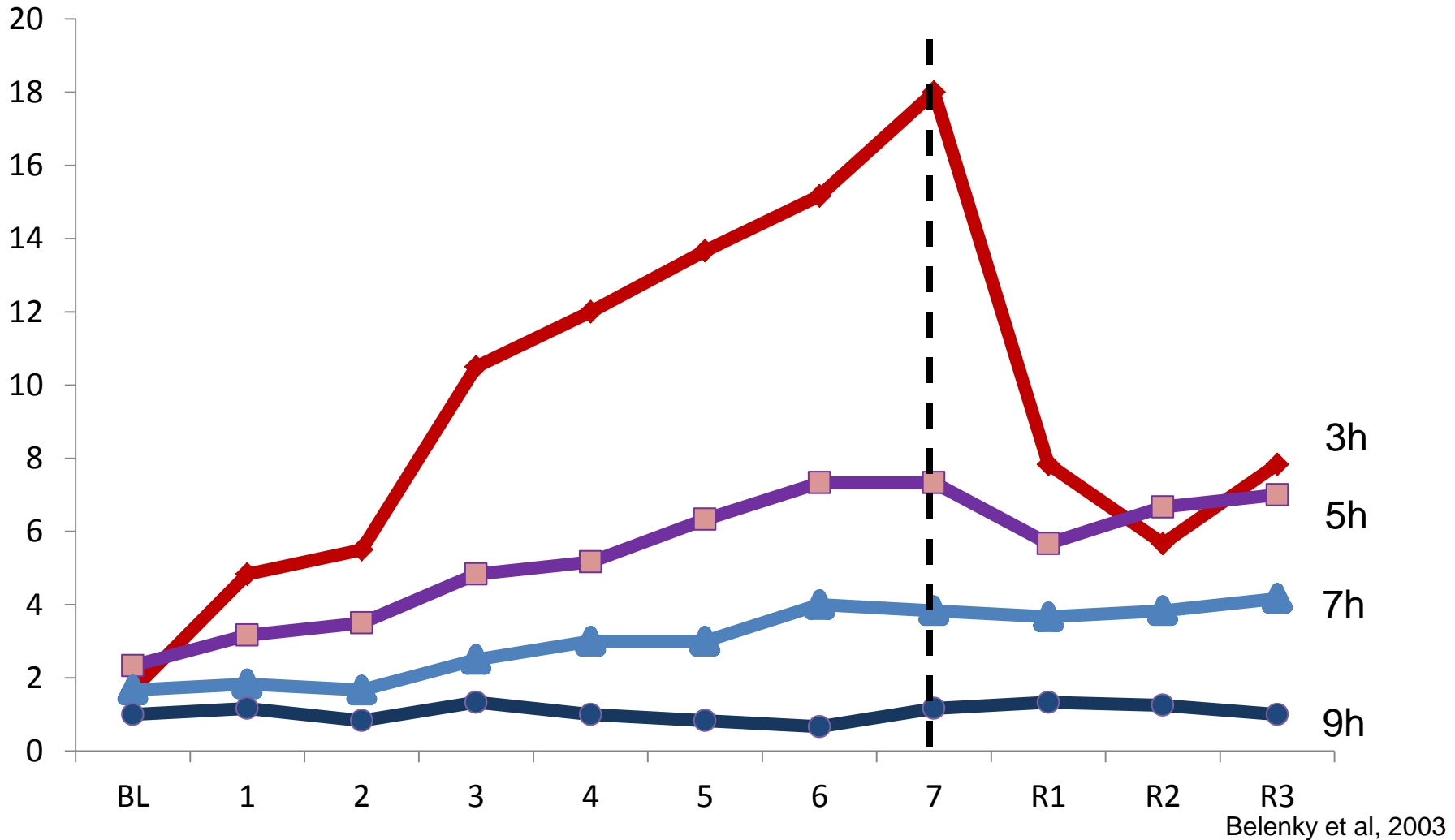
Sleep Loss Increases Errors



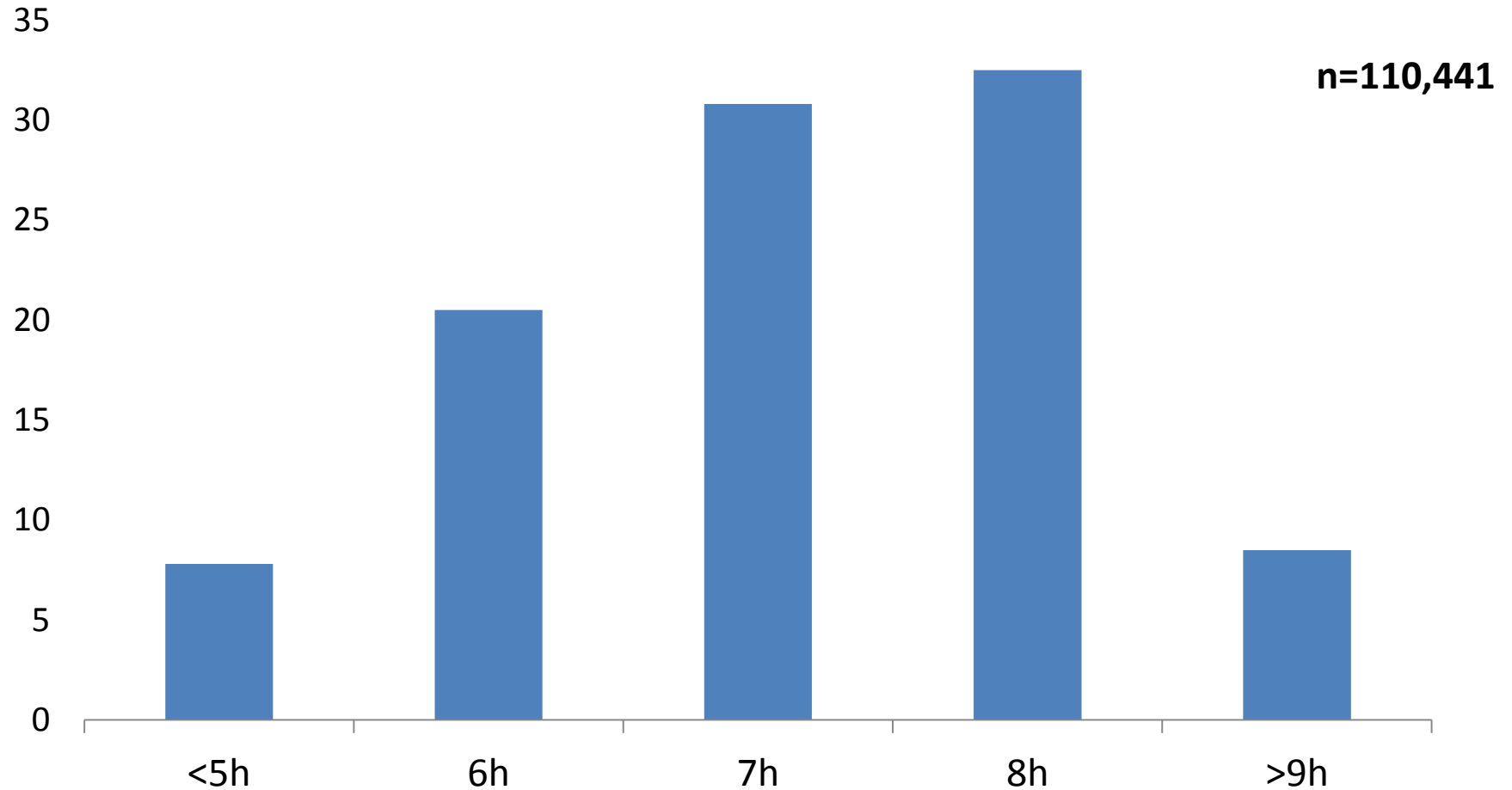
Acute And Cumulative Effects



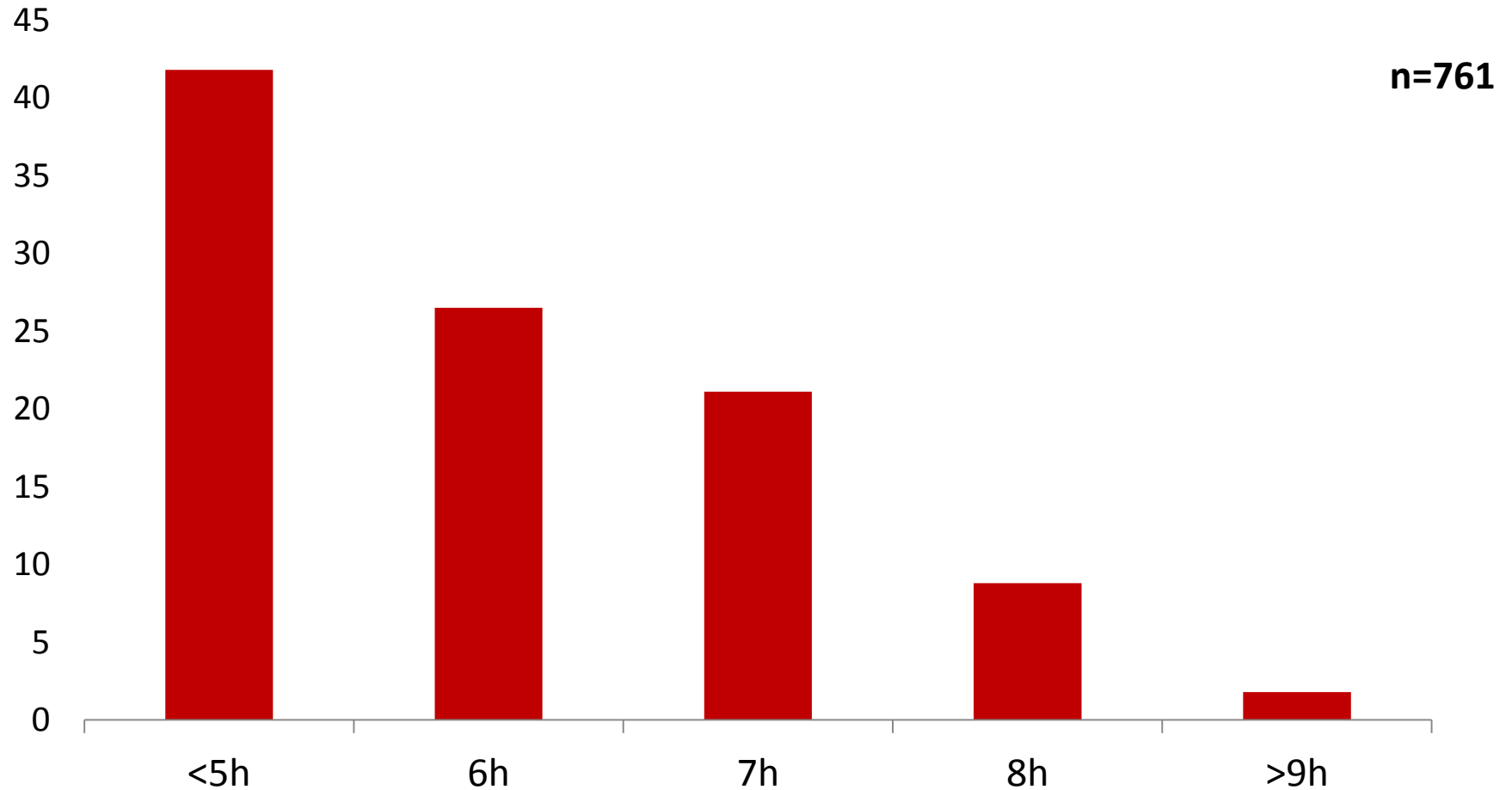
Catch Up On Weekends?



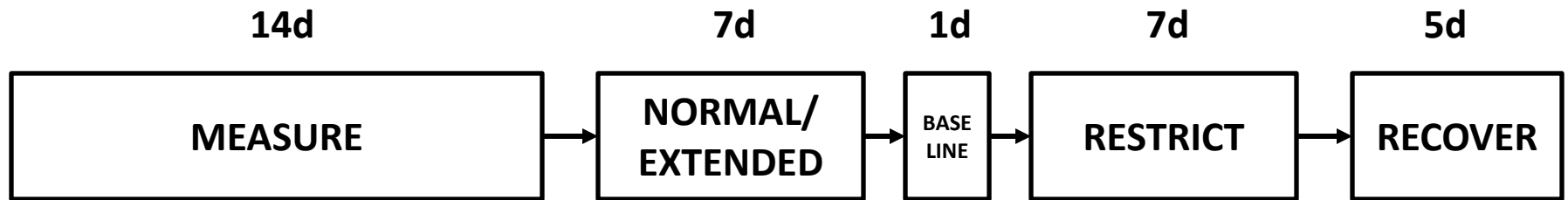
Most Americans: 7-8 Hours



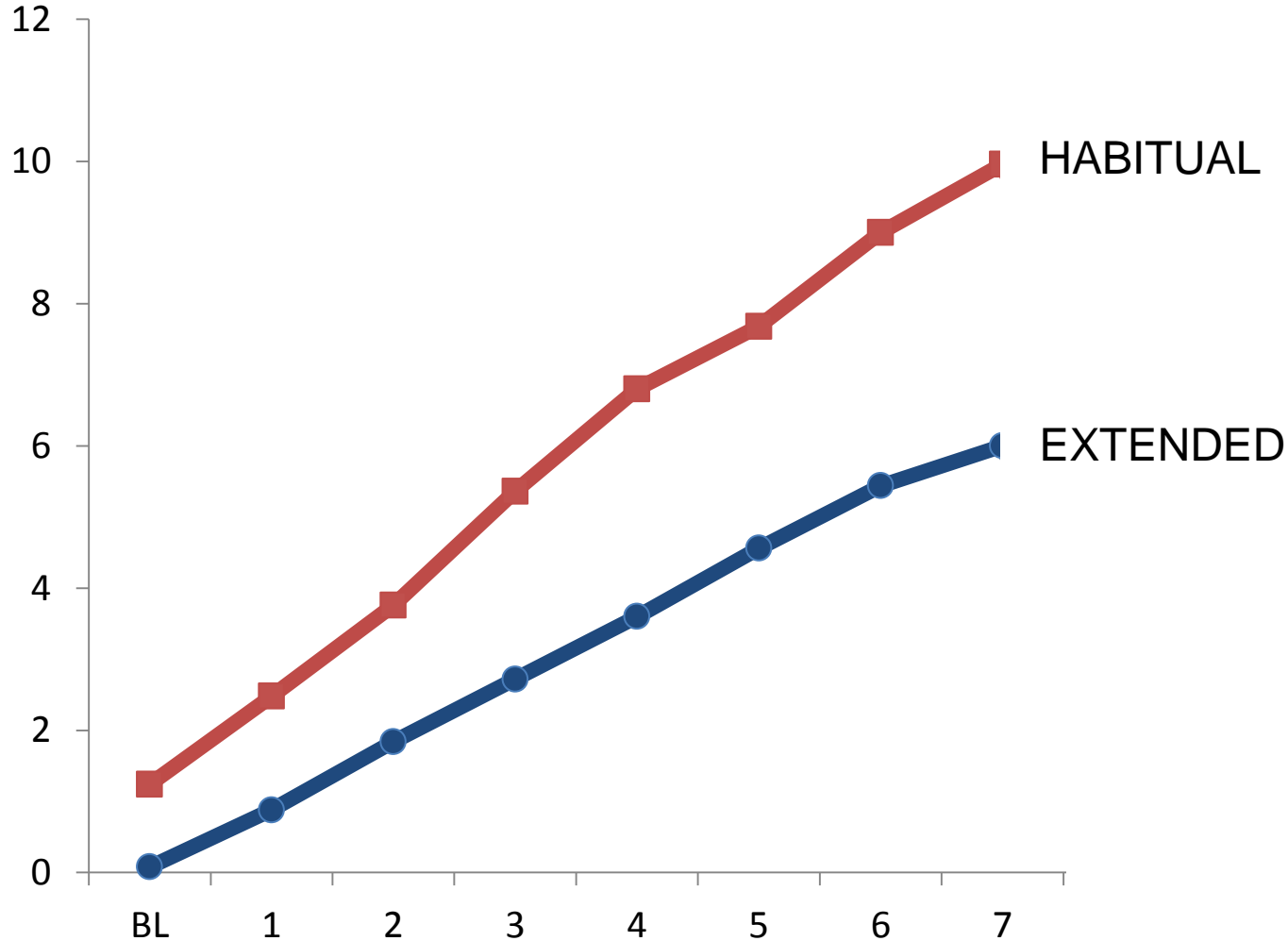
Most Soldiers: <5 Hours

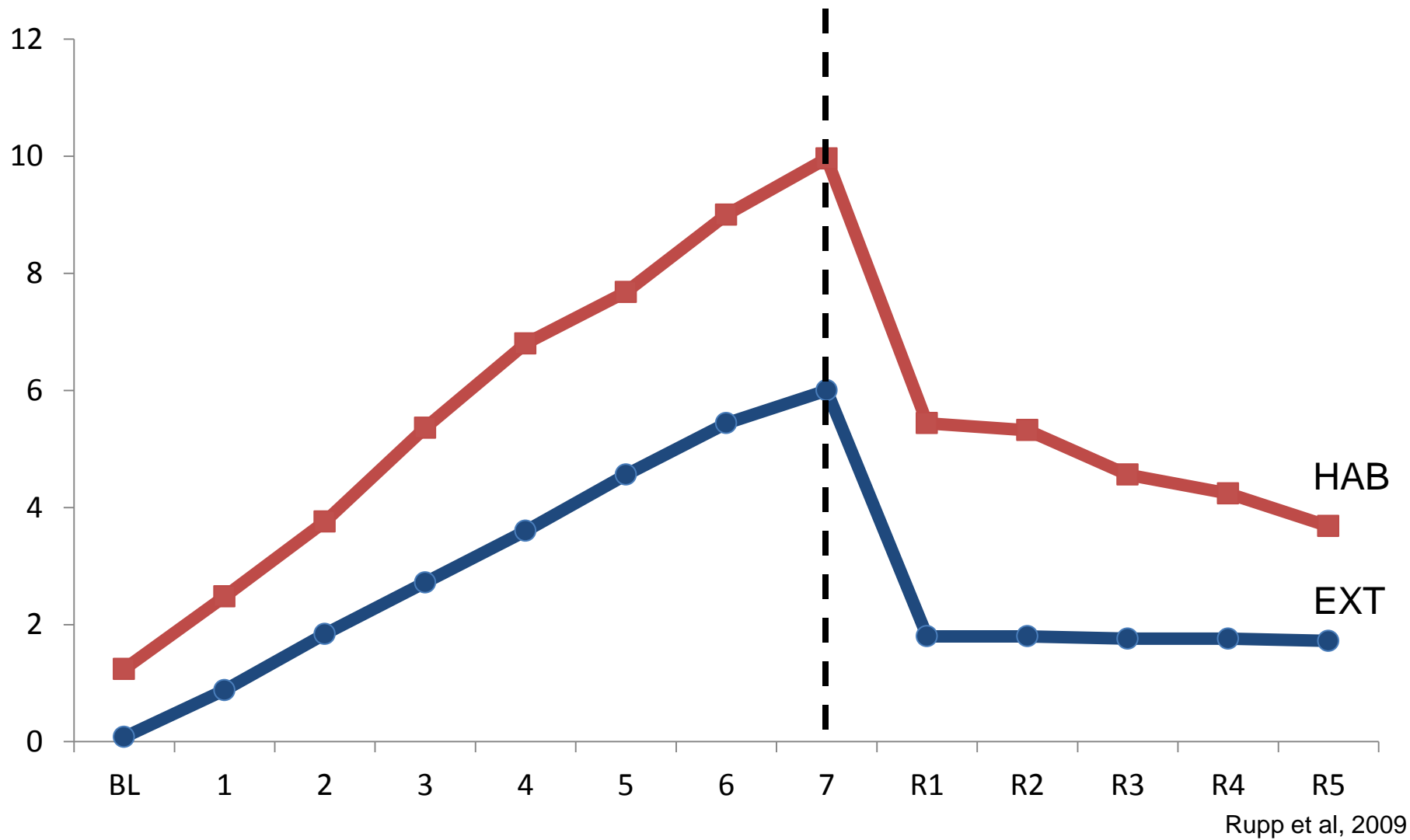


Preparing For Sleep Loss



Sleep Banking Reduces Errors





Sleep in TBI

Patient Complaints – What We Know

- Fragmented sleep
- Sleepiness and fatigue
- Circadian dysregulation

Sleep Disorders are Common in TBI

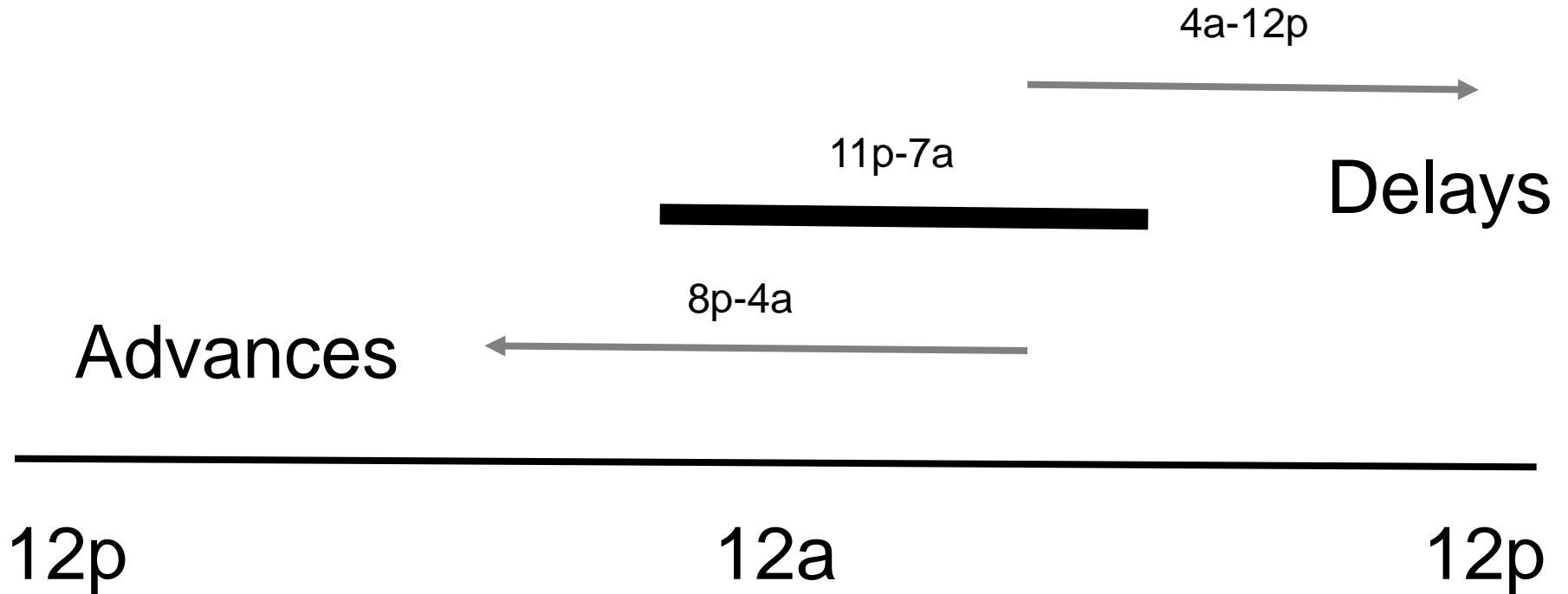
	Overall
Insomnia	0.29
Hypersomnia	0.28
Obstructive Sleep Apnea (OSA)	0.25
Periodic Limb Movement Disorder (PLMD)	0.19
Narcolepsy	0.04

Measurement Matters

	Overall	Clinical	PSG*	N
Insomnia	0.29	0.28	0.71	581 (4)
Hypersomnia	0.28	0.5	0.16	212 (3)
OSA	0.25	-	-	283 (6)
PLMD	0.19	-	-	212 (3)
Narcolepsy	0.04	0.03	0.06	152 (2)

*polysomnogram

Circadian Rhythm Disorders (CRD)



CRD Treatments

- Sleep hygiene
- Sleep scheduling
- Bright light – generally PUSHES*
- Melatonin – generally PULLS*

Narcolepsy Treatments

- Wake-promoting agents – MUST
- Behavioral treatments – IDEAL

Parasomnia Treatments

Behavioral

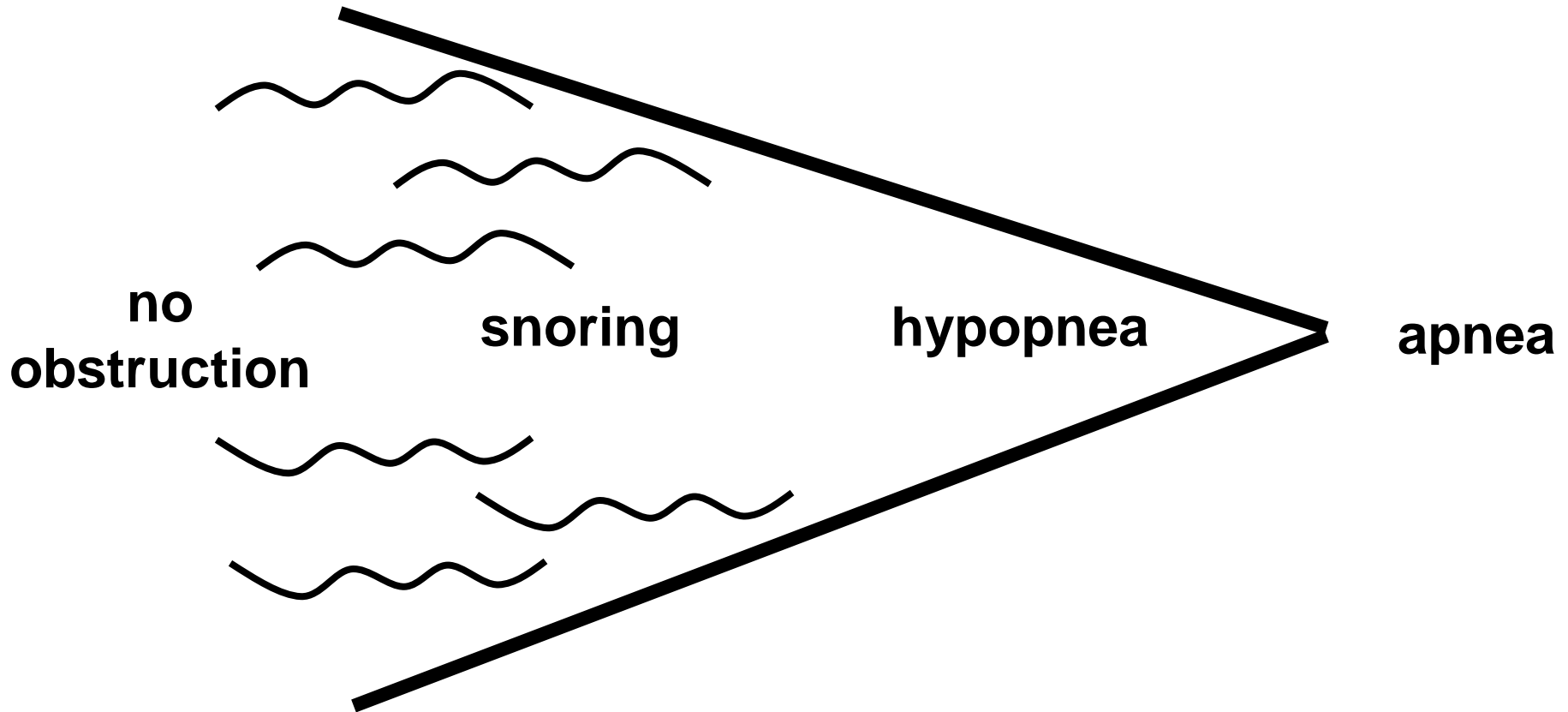
- Sleep hygiene
- Sleep extension
- Imagery rehearsal

Medication

- Prazosin – nightmares
- Benzodiazepines – acting out behaviors

**Upper Airway
Resistance Syndrome
(UARS)**

**Obstructive
Sleep Apnea
(OSA)**



Apnea-Hypopnea
Index (AHI)

(OSA only)

<5 none

5-14 mild

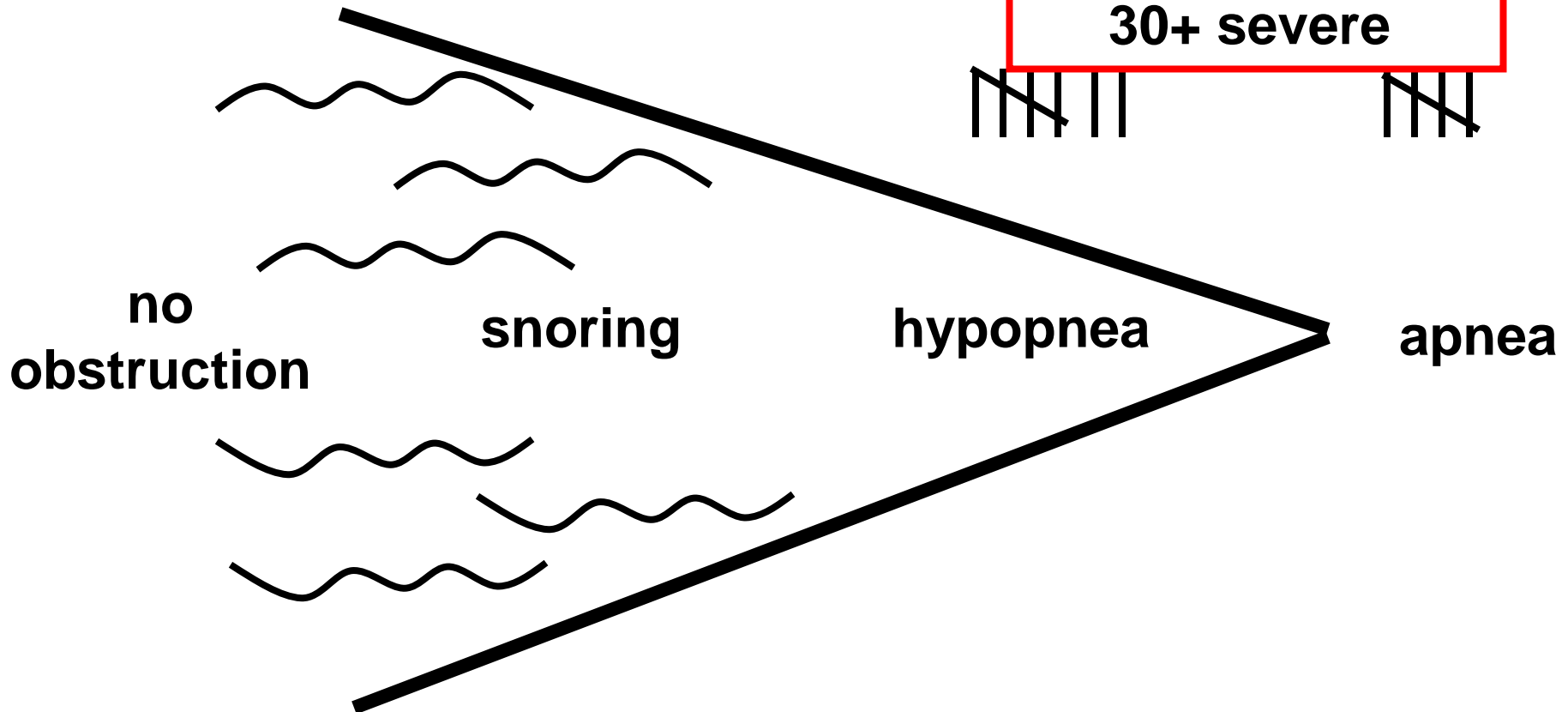
15-29 mod

30+ severe

UARS

flow-limited breaths

*subtle detection



Mechanisms of sleep-related breathing disorder

↓ O₂

↑ EEG arousal

↓ total sleep

OSA Treatments

- Conservative/lifestyle approaches
- Positive airway pressure
- Oral appliance
- Surgical approaches/Devices

Positive Airway Pressure (Pap) Works

- 36 randomized controlled trials, N=1718

vs control

- ↓ objective & subjective sleepiness
- ↑ quality of life
 - neurocognitive function

vs oral appliance (OA)

- ↓ AHI
- ↑ sleep efficiency
- ↑ minimum O₂

LESS BAD

eliminates OSA (95+%)

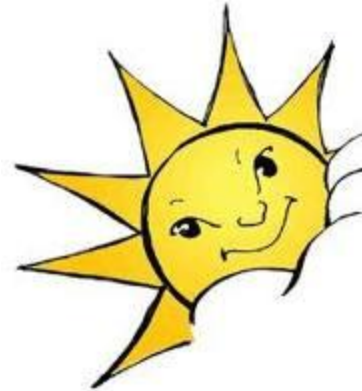
- ↓ sleepiness
- ↓ hospitalizations
- ↓ car accidents
- ↓ hypertension (especially nocturnal)
- ↓ pulmonary artery pressures
- ↓ gastroesophageal reflux disease

MORE GOOD

- ↑ quality of life
- ↑ cognition
- ↑ glucose control
- ↑ gas exchange
- ↑ heart function in heart failure patients
- ↓ reduces cardiac arrhythmias during sleep

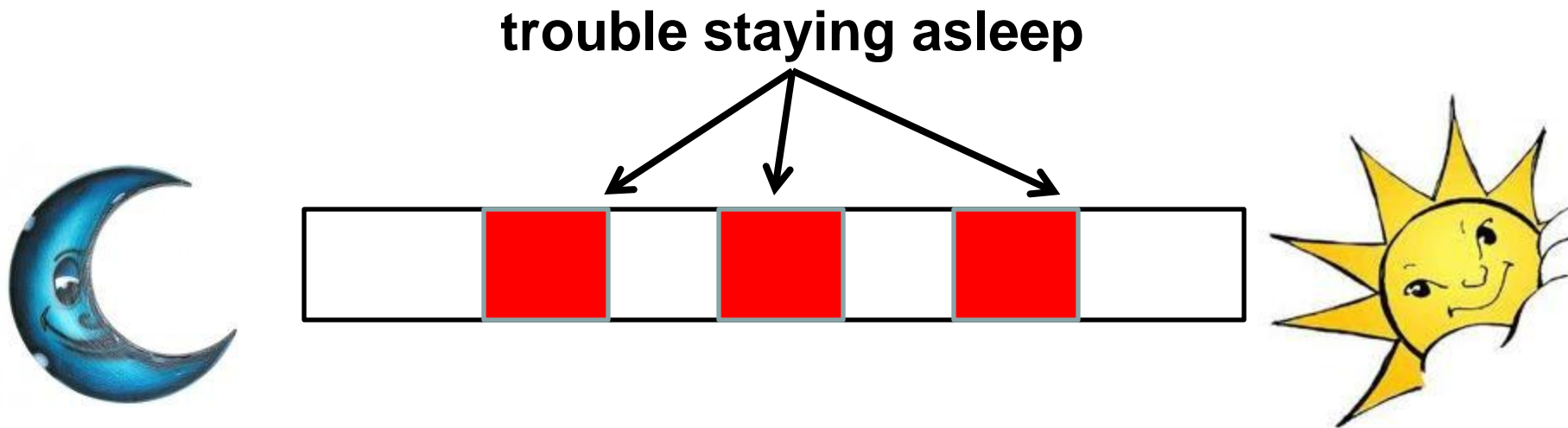
Sleep Onset Insomnia

trouble falling asleep



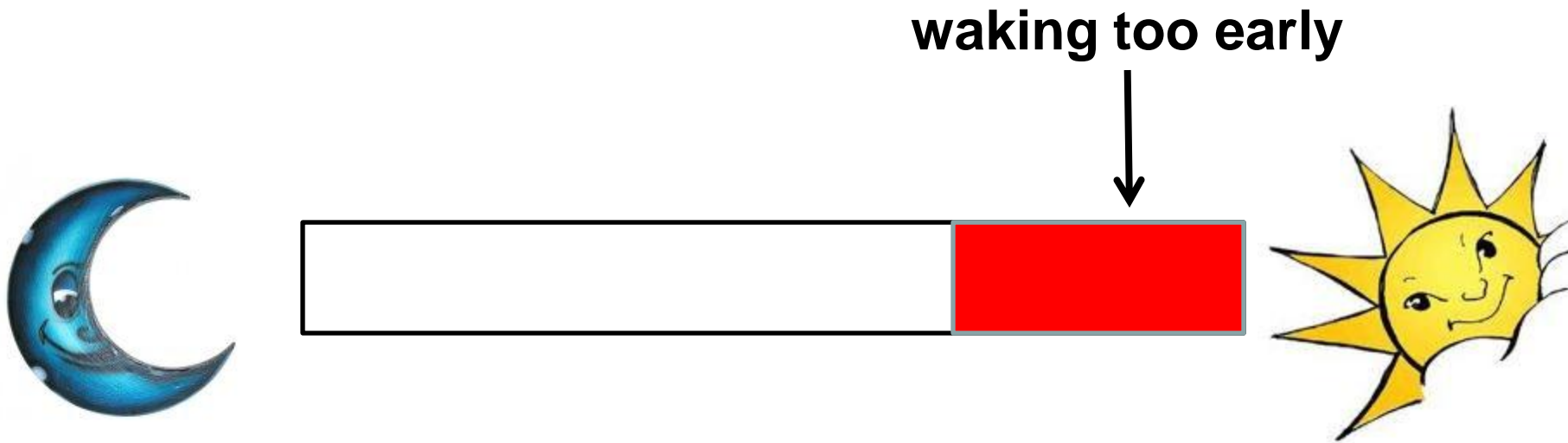
Source: Emerson Wickwire, Ph.D.

Sleep Maintenance Insomnia



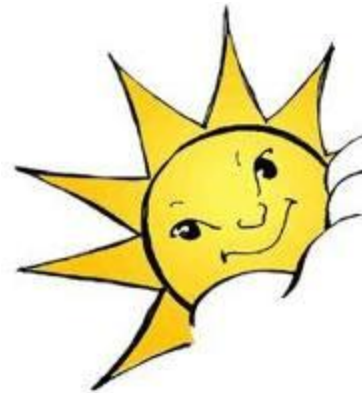
Source: Emerson Wickwire, Ph.D.

Early Morning Awakening



Source: Emerson Wickwire, Ph.D.

Insomnia Symptoms Frequently Overlap & Complaints May Change Over Time



Source: Emerson Wickwire, Ph.D.



DAYTIME CONSEQUENCE

Daytime consequences

- Fatigue/malaise
- Attention, concentration, or memory impairment
- Social/vocational dysfunction or poor school performance
- Mood disturbance/irritability
- Daytime sleepiness
- Motivation/energy/initiative reduction
- Proneness for errors/accident at work or while driving
- Tension headaches/gastrointestinal symptoms
- Concerns or worries about sleep

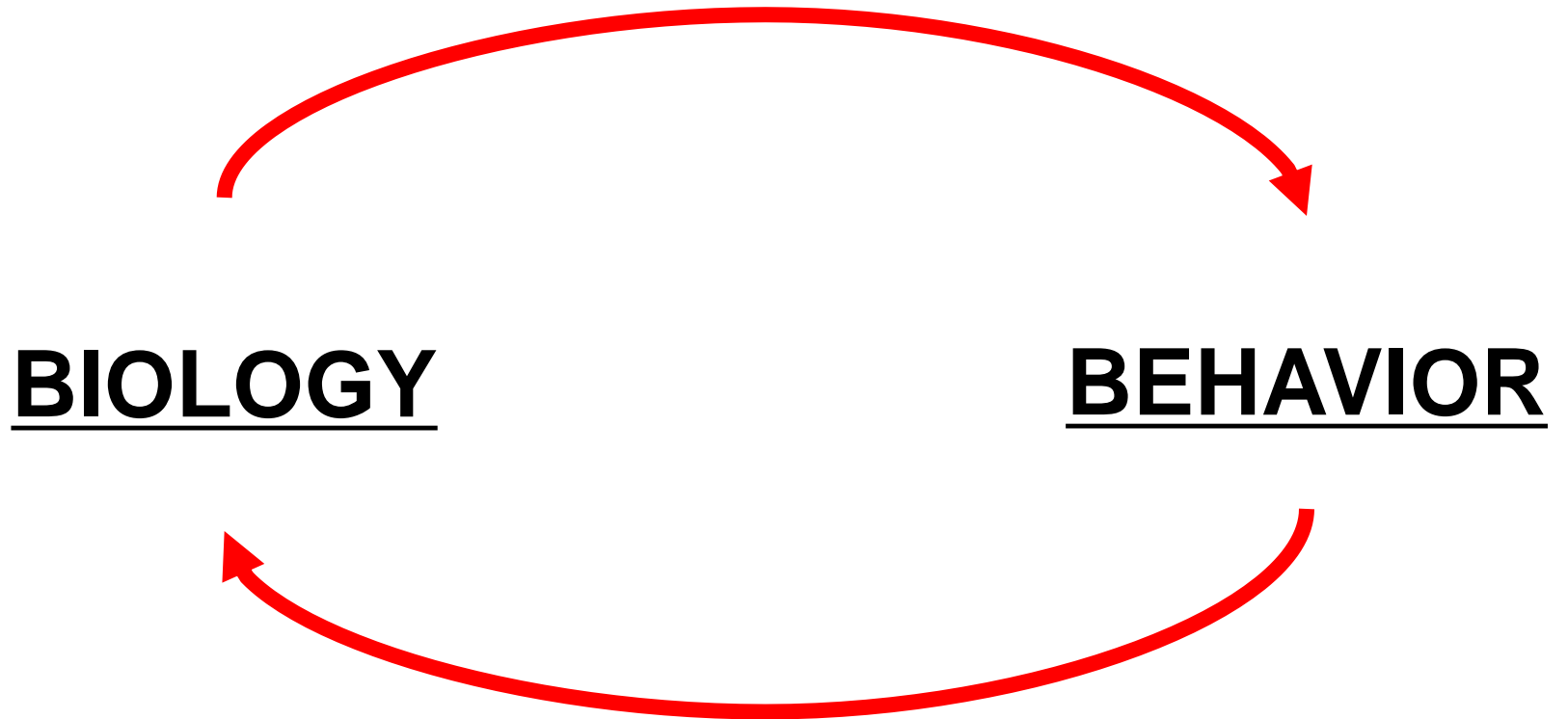
Old thinking

BIOLOGY



BEHAVIOR

Better understanding



How insomnia develops:

Biobehavioral Pathway

Insomnia

No Insomnia

Insomnia

No Insomnia



Predisposing
Risk Factors

Biology/ Hard-wiring
Personality
Temperament

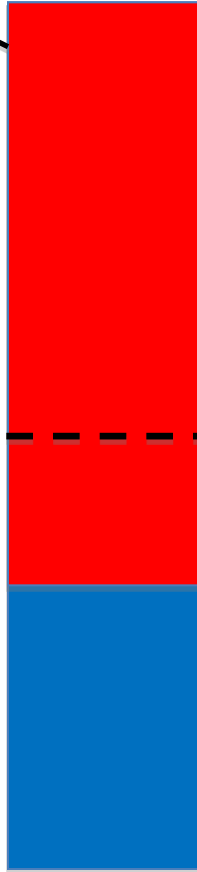
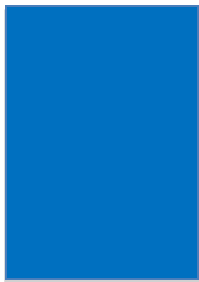
**Environmental
Stressor**

Medical illness
Loss of loved one
Job transition
Cumulative effect



Insomnia

No Insomnia



**Predisposing
Risk Factors**

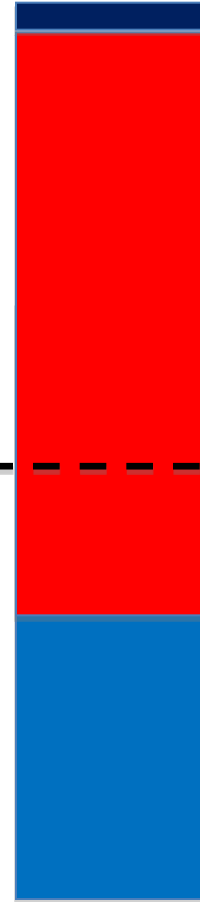
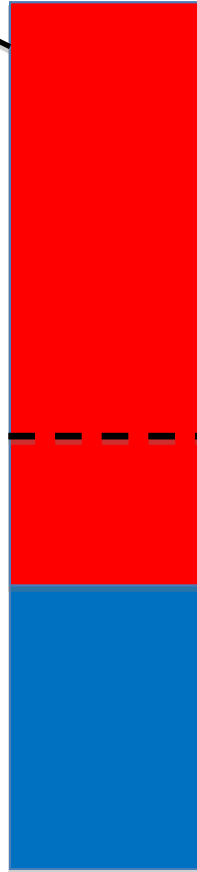
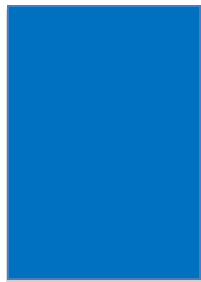
**Environmental
Stressor**

**“Compensatory”
Behaviors**



Insomnia

No Insomnia



Spend more time in bed

“Try harder” to sleep

Go to bed earlier

Sleep in on weekends

Take naps

Sleep outside bedroom

Overuse caffeine/stimulants

Decrease daytime activity

Various OTC sleep aids

Obsess/ overfocus on sleep

**Predisposing
Risk Factors**

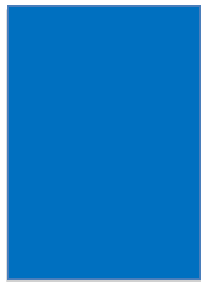
Environmental
Stressor

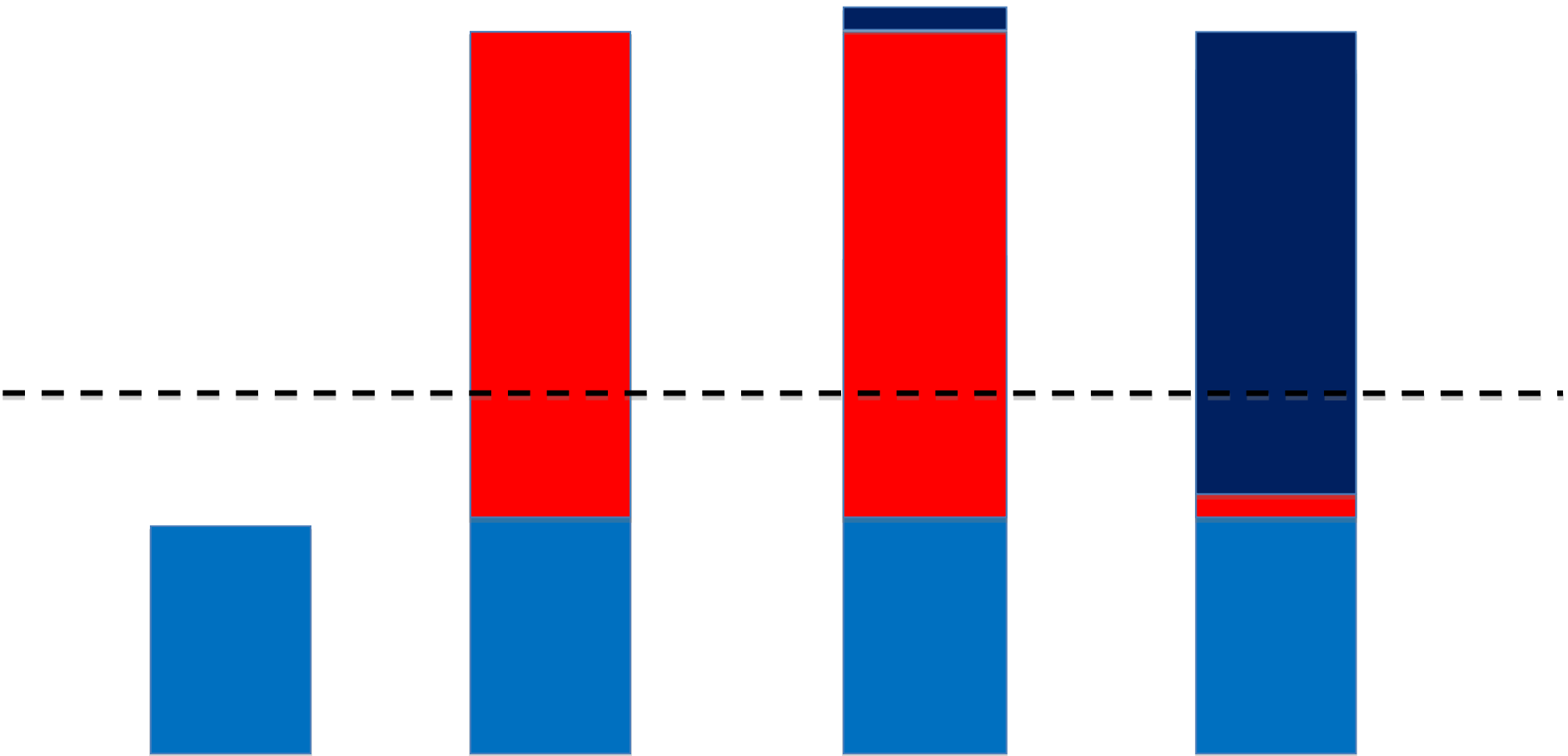
“Compensatory”
Behaviors

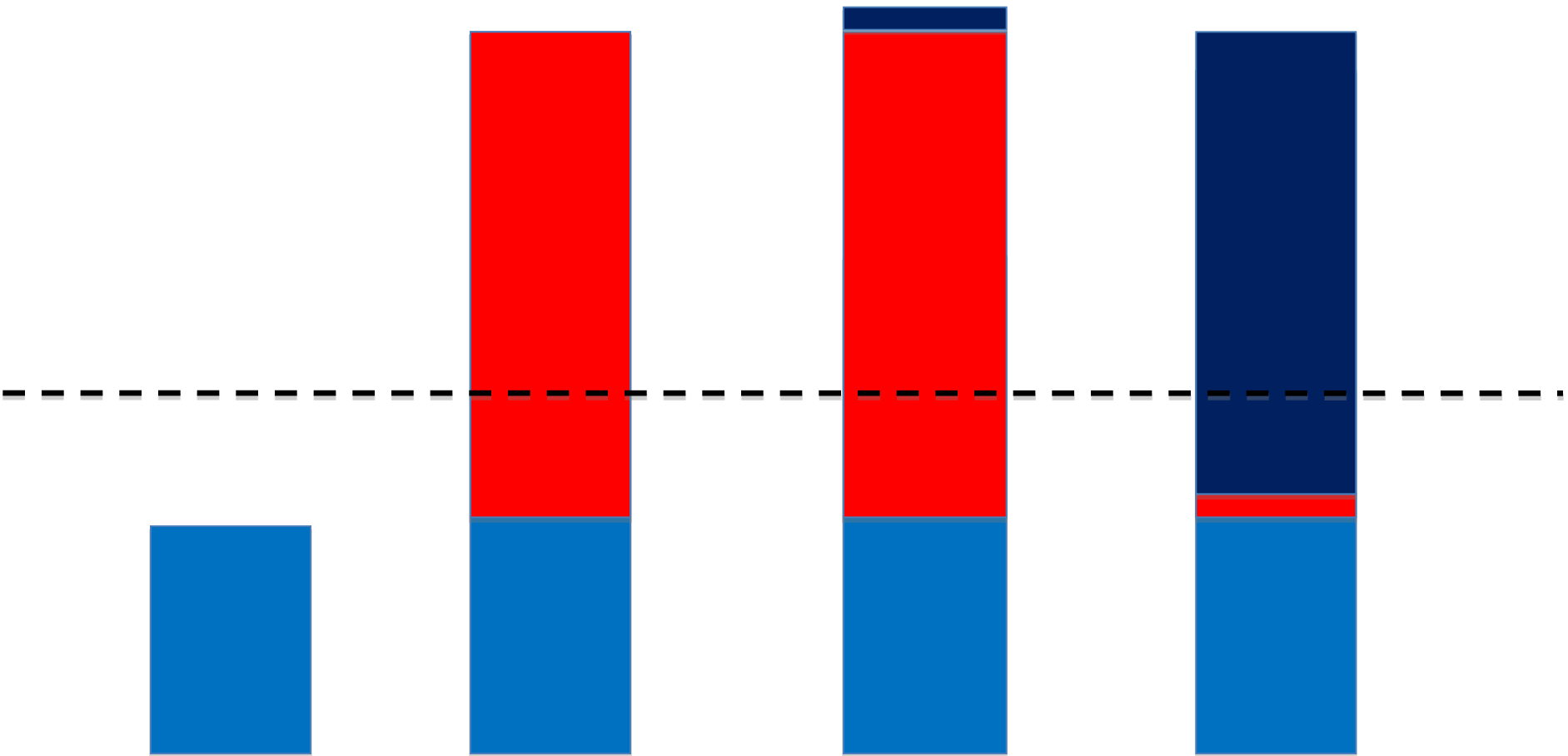
Insomnia

No Insomnia

Predisposing
Risk Factors



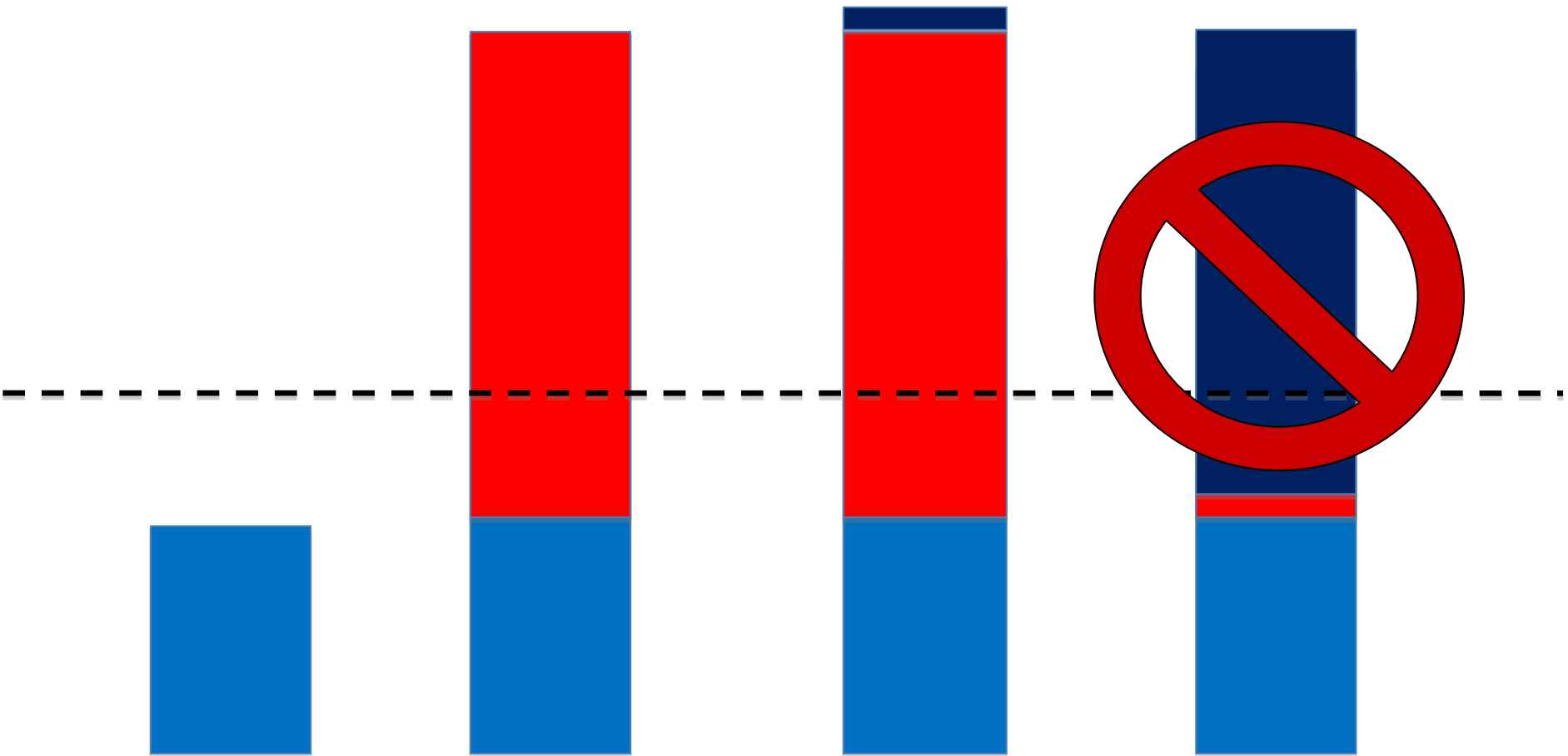




ACUTE



CHRONIC
(\geq 3 mo)



CBT-I

Problem:

You've had a lot of practice at being a lousy sleeper, and you've become quite good at it!

Solution:

We will re-train your body to sleep.

Insomnia Treatments

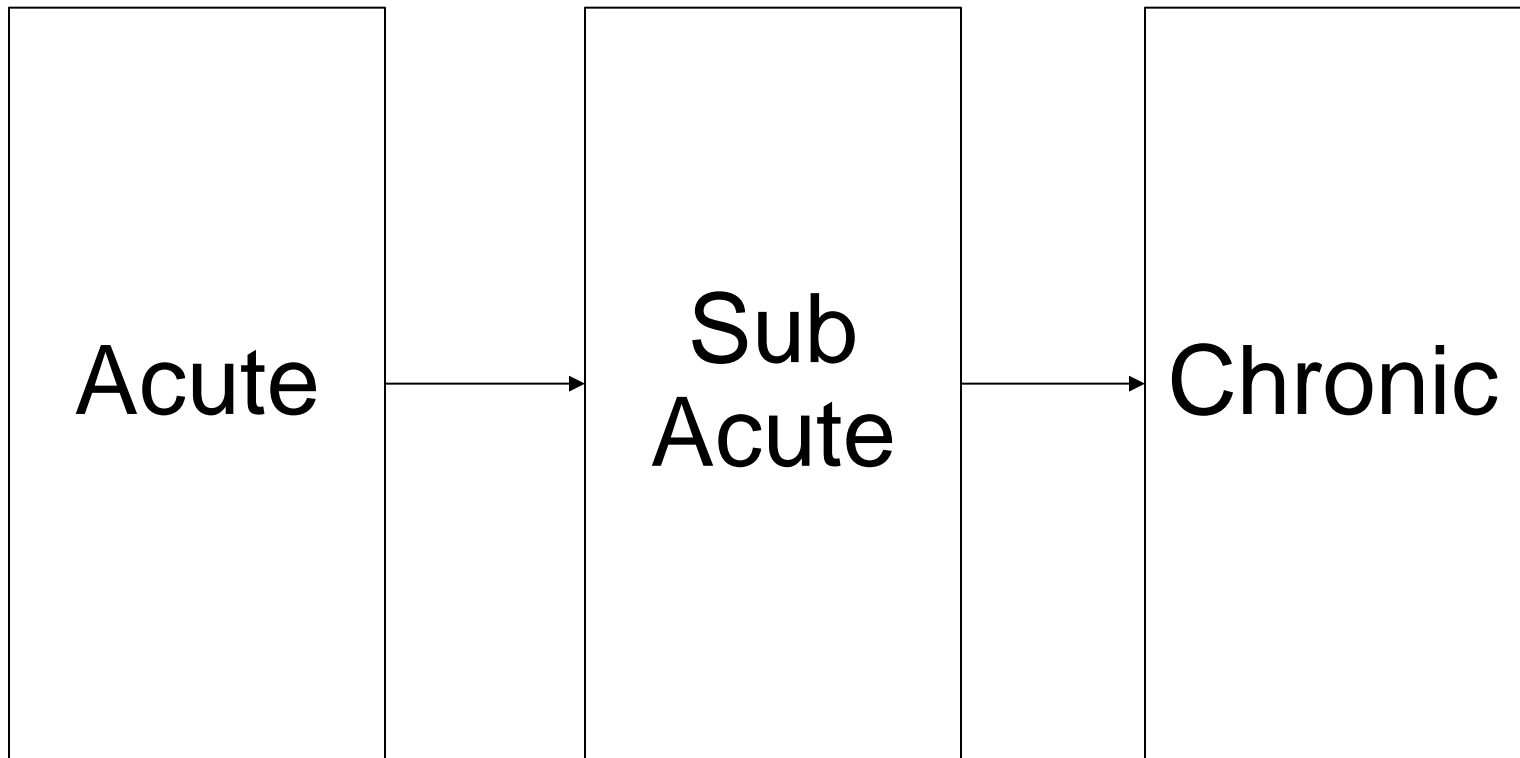
Multiple FDA-approved medications

- Use with caution
- Avoid benzodiazepines

Cognitive-behavioral treatments

- Longer-lasting benefit
- Shortage of providers

Role of Sleep in Recovery Process?



Research Priorities

Infrastructure

- Multisite data repository

Serial Assessment

- Multiple methods

Treatment Development

- Post-traumatic hypersomnia
- Post-traumatic circadian rhythm disorders
- Sleep as therapy – induction of slow wave sleep

Fatigue

- The awareness for a decreased capacity for physical and/or mental activity due to imbalance in the availability, utilization and/or restoration of resources to perform activity.

Ponsford et al., 2012

- “Decreased energy” or “decreased endurance” for physical and mental activities.

Fatigue

- #1 complaint among moderate-severe TBI
 - Especially in early post-traumatic period
 - May become a chronic issue
- #2 complaint among outpatients
- More than 60% report fatigue that interferes with function.

Ponsford et al., 2012

Fatigue

- Mental fatigue
- Physical fatigue
- Strong interplay
 - Increased physical fatigue will lead to increased mental fatigue, cognitive slowing, etc.

Fatigue

- Endocrine dysfunction
 - 15-68% incidence of hypopituitarism
- Treat with hormone replacement if symptomatic and/or > 1 year post-TBI

Tritos, Yuen, & Kelly, 2015

Fatigue

- Is there an underlying sleep problem?
 - If so, treat it!
- Encourage increased physical activity/exercise.
- Return to work/school
 - Gradual increase in hours
- Caffeine

Fatigue

- Pharmacological management
 - Treatment to reduce fatigue = improve alertness
- Stimulants
 - Methylphenidate, amphetamine/dextoramphetamine, etc.
 - Modafinil, armodafinil
 - Selective serotonin reuptake inhibitors

Fatigue

- Non-pharmacological management
- Interdisciplinary approach
 - Inpatient
 - Outpatient

What is new on the horizon for fatigue?

- Blue light (short wave) therapy
 - 45 minutes each morning reduced fatigue in TBI patients with chronic fatigue

Sinclair, Ponsford, Taffe, Lockley, & Rajaratnam, 2014
 - 3 groups
 - Blue light
 - Yellow light (placebo)
 - No treatment
 - Primary outcome: fatigue
 - Secondary outcomes: daytime sleepiness, depression, sustained attention, sleep quality
 - Improved fatigue & daytime sleepiness

Summary

- Sleep dysfunction, poor arousal, inattention, decreased alertness/fatigue are significant sequelae of TBI which affect patient's ability to function as well as their quality of life
- There is significant overlap between TBI, sleep disturbances, other post-TBI symptoms and other disorders, such as post-traumatic stress disorder, depression and chronic pain.
- Until there are more sensitive tests for mTBI, symptoms should be considered independently, but managed holistically.

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Running head: Sleep and mild traumatic brain injury.

Questions

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- We will respond to as many questions as time permits.



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